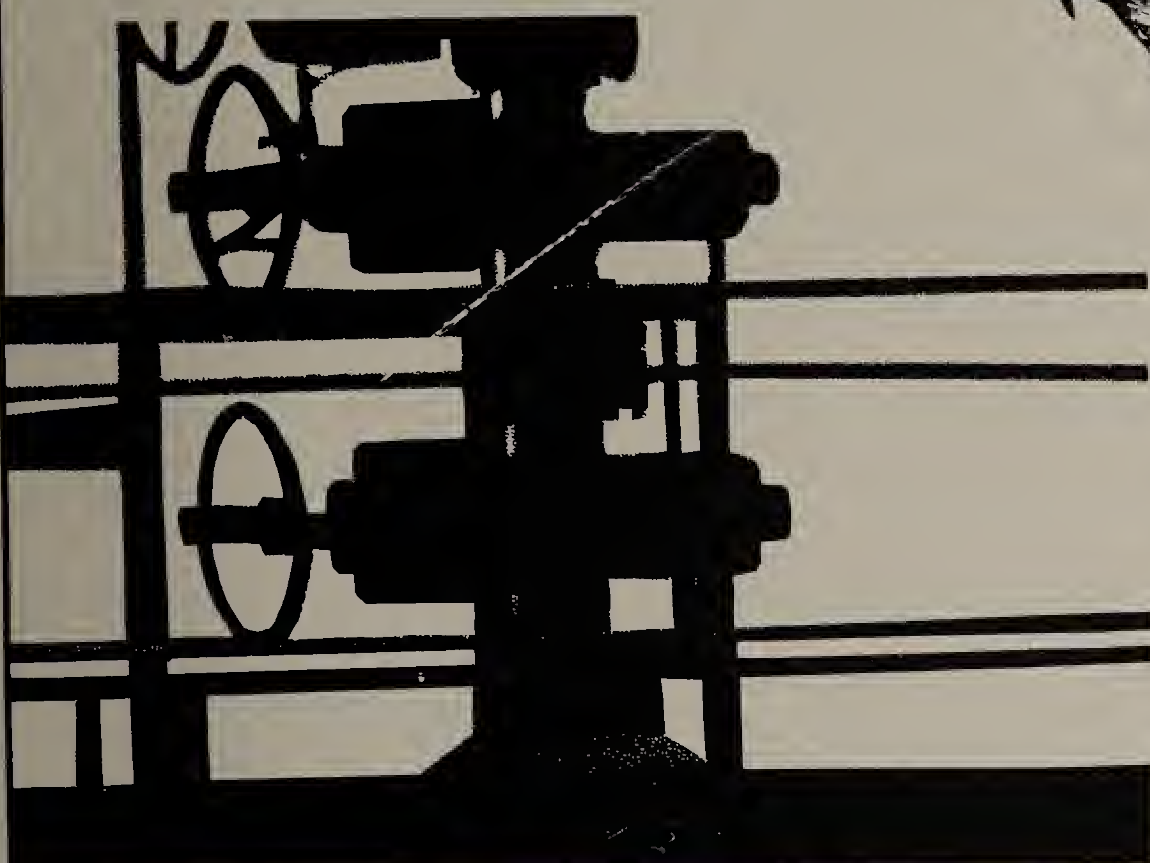
RILEY RIDGE NATURAL GAS PROJECT

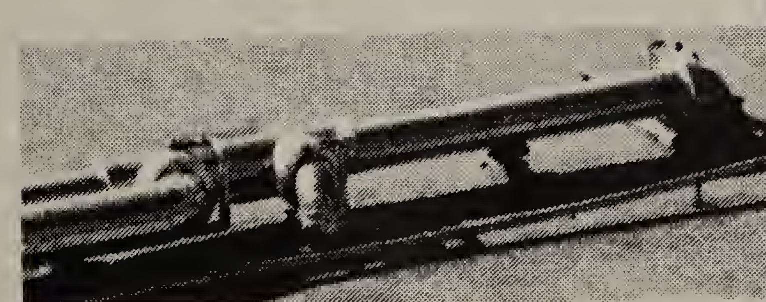
PROPOSED ACTION TECHNICAL REPORT

MAY 1983

Prepared by:
ENVIRONMENTAL RESEARCH
AND TECHNOLOGY, INC. for

DEPARTMENT OF INTERIOR
BUREAU OF LAND MANAGEMENT
DEPARTMENT OF AGRICULTURE
FOREST SERVICE





PROPOSED ACTION TECHNICAL REPORT

FOR THE

RILEY RIDGE ENVIRONMENTAL IMPACT STATEMENT

May 1983

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INTRODUCTION

American Quasar Petroleum Company (Quasar), Williams Exploration Company (Williams), Exxon Company, USA (Exxon), Northwest Pipeline Corporation (Northwest), and Mobil Oil Corporation (Mobil) propose to develop, produce, treat, and transport natural gas from a new deep gas well field in western Wyoming. The planned production is from previously explored but undeveloped reservoirs below 14,000 feet. The project participants are proposing to produce a significant supply of low-Btu natural gas and process it to pipeline quality. The gas (called sour gas) contains methane (CH_4), carbon dioxide (CO_2), hydrogen sulfide (H_2S), nitrogen (N_2), helium (He), and other inert gases when extracted from the well field. The sour gas would be transported by pipelines from the well field to treatment plants where by-products and impurities would be removed, and the natural (sales) gas would be prepared for shipment to available markets by sales gas pipelines. Small amounts of sulfur dioxide (SO_2) and large amounts of N_2 would be vented to the atmosphere.

Certain by-products (CO_2, He, and sulfur) are of commercial value if markets can be identified during the life of the project and may be transported by pipeline, truck, or rail to potential markets (see Figure 1-1). All applicants plan to vent CO_2 until markets can be identified. At that time, the proposed CO_2 pipelines would be constructed and CO_2 would be shipped to the respective markets.

The Riley Ridge Project would consist of the construction, operation, and abandonment of the following components:

- Well field;
- Gathering pipelines for the transportation of sour gas within the well field;
- Trunk lines for the shipment of sour gas from the terminus of the well field gathering systems to the proposed treatment plants;
- Treatment plants;
- Sales gas pipelines for shipment of sweet gas to existing main pipelines;
- Facilities for the handling and transportation to proposed markets of by-products (sulfur and CO_2) removed during the treatment process, if markets are developed during the life of the project; and
- Ancillary facilities.

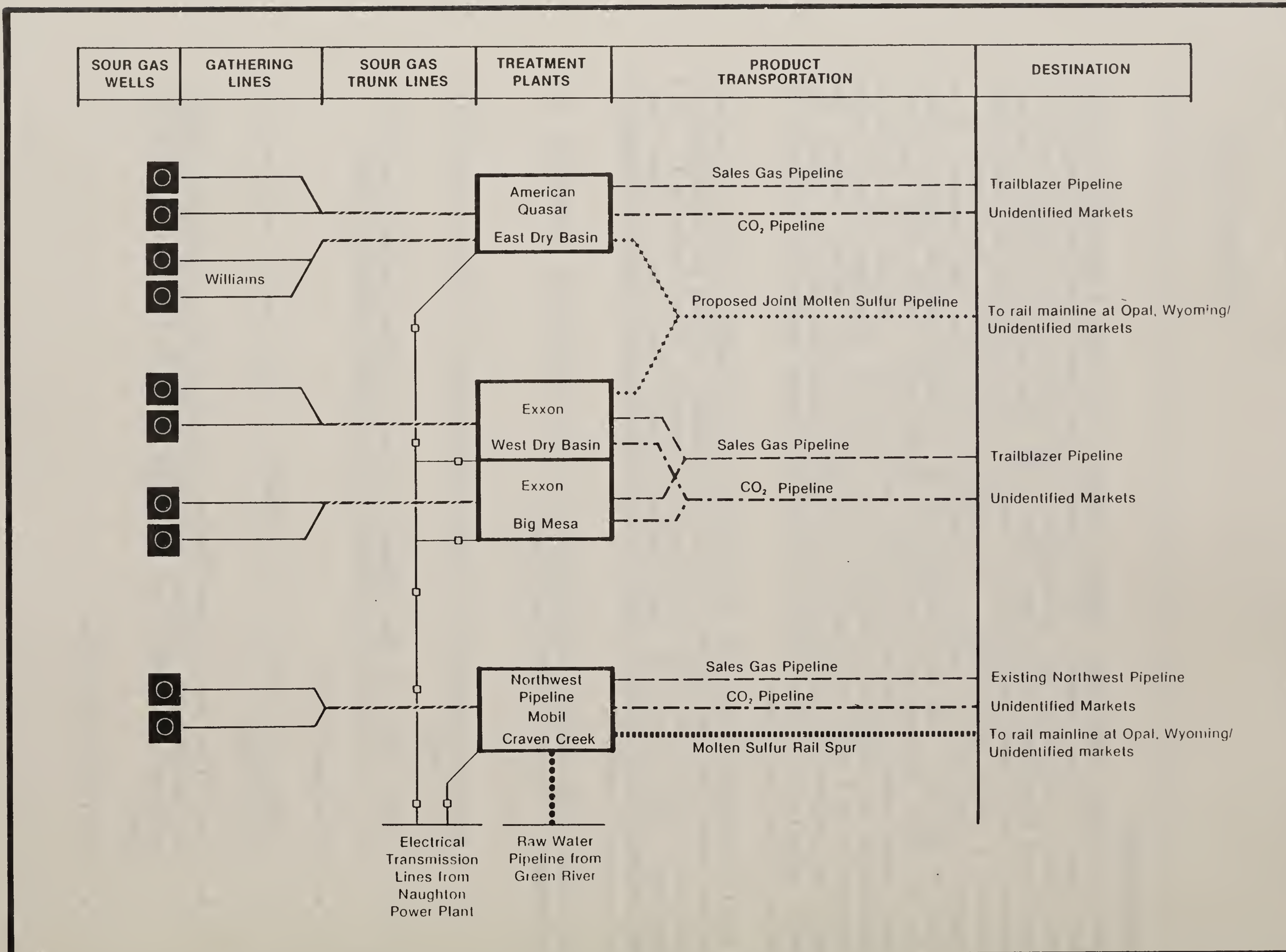


FIGURE 1-1 SCHEMATIC OF RILEY RIDGE PROJECT COMPONENTS

A final determination must be made by the agencies concerning the disposition of the carbon dioxide (CO_2) prior to the issuance of the FEIS. The alternatives for the disposition of this gas are to either require sales or allow venting. The decision of what royalties may be due to the U.S. Government, and under what conditions they may be due must also be resolved.

At present the agencies prefer that the CO_2 be allowed to vent until an economic market is identified. At that time, the CO_2 will be either sold, or compensatory royalty will be assessed for the marketable amount at the normal royalty rate. The availability of an economic market will be jointly evaluated on an annual basis by the BLM and MMS.

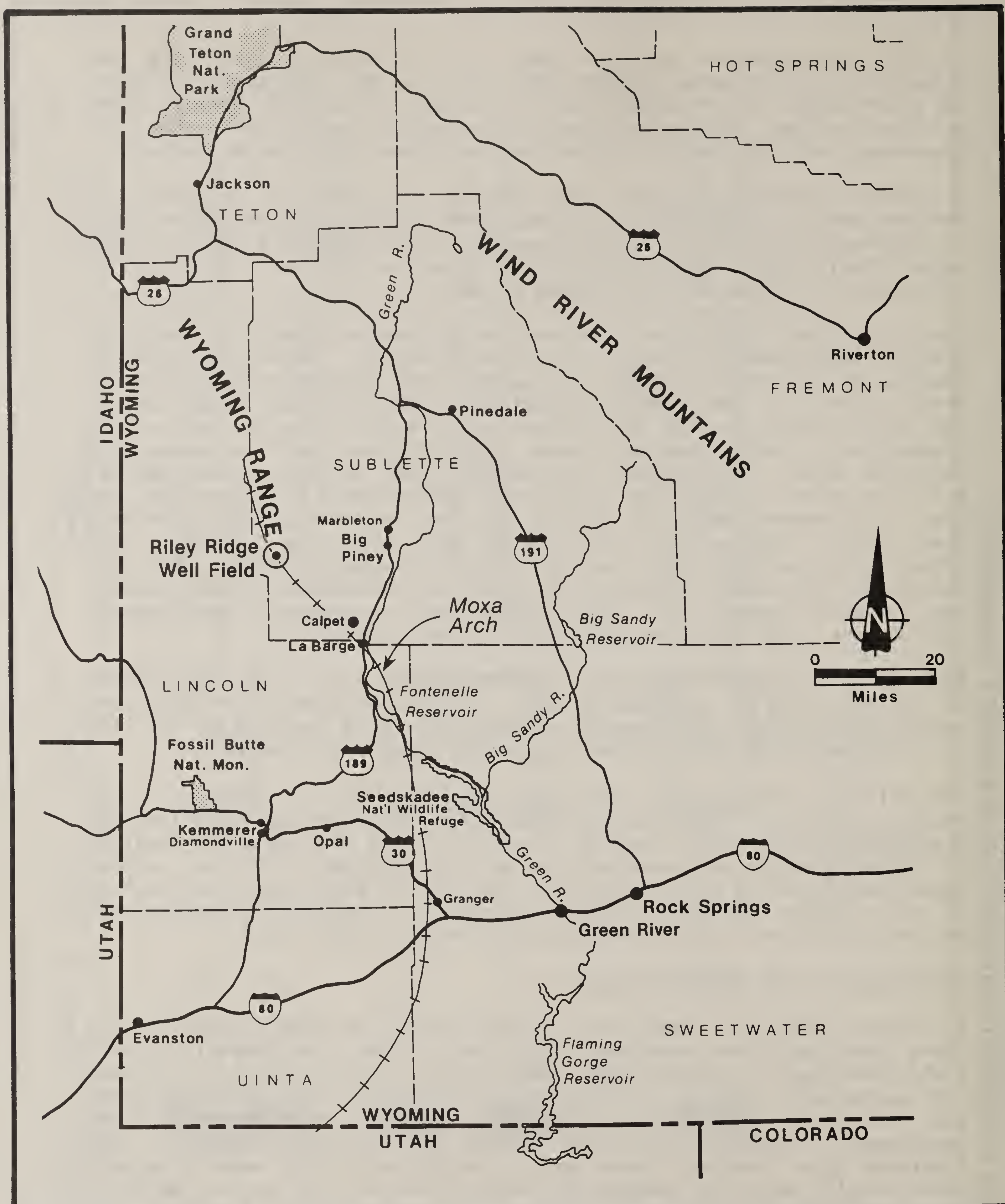
The Riley Ridge Project area is located in southwestern Wyoming in Sublette, Lincoln, and Sweetwater Counties as shown on Map 1-1. Major physiographic features of the region include the Wyoming Range extending in a north-south direction west of the proposed project area, the Wind River Range east of the project area, and the Green River approximately 13 miles east of the proposed well field. Numerous creeks drain the area and flow eastward to the Green River. Nearby towns include Big Piney, Marbleton, and LaBarge, all of which are located east of the well field along U.S. Highway 189, and Opal and Kemmerer which are located southwest of the southern treatment plant sites. Portions of the proposed well field are located in the Bridger-Teton National Forest and the BLM Rock Springs District, while the balance of the project is located on Bureau of Reclamation-managed, state, and privately owned land. The project area encompasses approximately 496,000 acres, 163,000 of which are within the well field.

Exploration for deep, low-BTU gas has been ongoing since 1979. Development of the well field is scheduled to begin following issuance of the necessary permits in mid-1984. Development and operation would continue for the life of the project, which at this time is expected to be 30 to 40 years.

The following table and figures provide a descriptive overview of the project. Table 1-1 summarizes the Riley Ridge components and identifies the associated participating companies. Map 1-2 in the DEIS shows the location of the well field and each unit as well as proposed well sites, access roads, and gathering system pipelines. Map 1-3 (in DEIS) shows the location of the corridors and major project components. A schedule extending over the expected 40-year life of the project is shown on Figure 1-2.

DESCRIPTION OF THE PROPOSED ACTION

The Proposed Action is described in the following sections addressing well field development and treatment facilities of the five companies. Well field development includes access road and well pad construction, drilling and completion of the well, followed by construction of the gathering system and electrical transmission facilities, and wellhead operation and abandonment. Treatment facilities include the following components: the treatment plant modules, power supply, solid and liquid waste disposal, water supply, ancillary components, sulfur pipeline and loadout facility, sales gas pipelines, and the railroad spur. Construction, operation, and abandonment phases of the proposed plants are included.



MAP 1-1 REGIONAL LOCATION MAP

TABLE 1-1

RILEY RIDGE PROJECT COMPONENTS

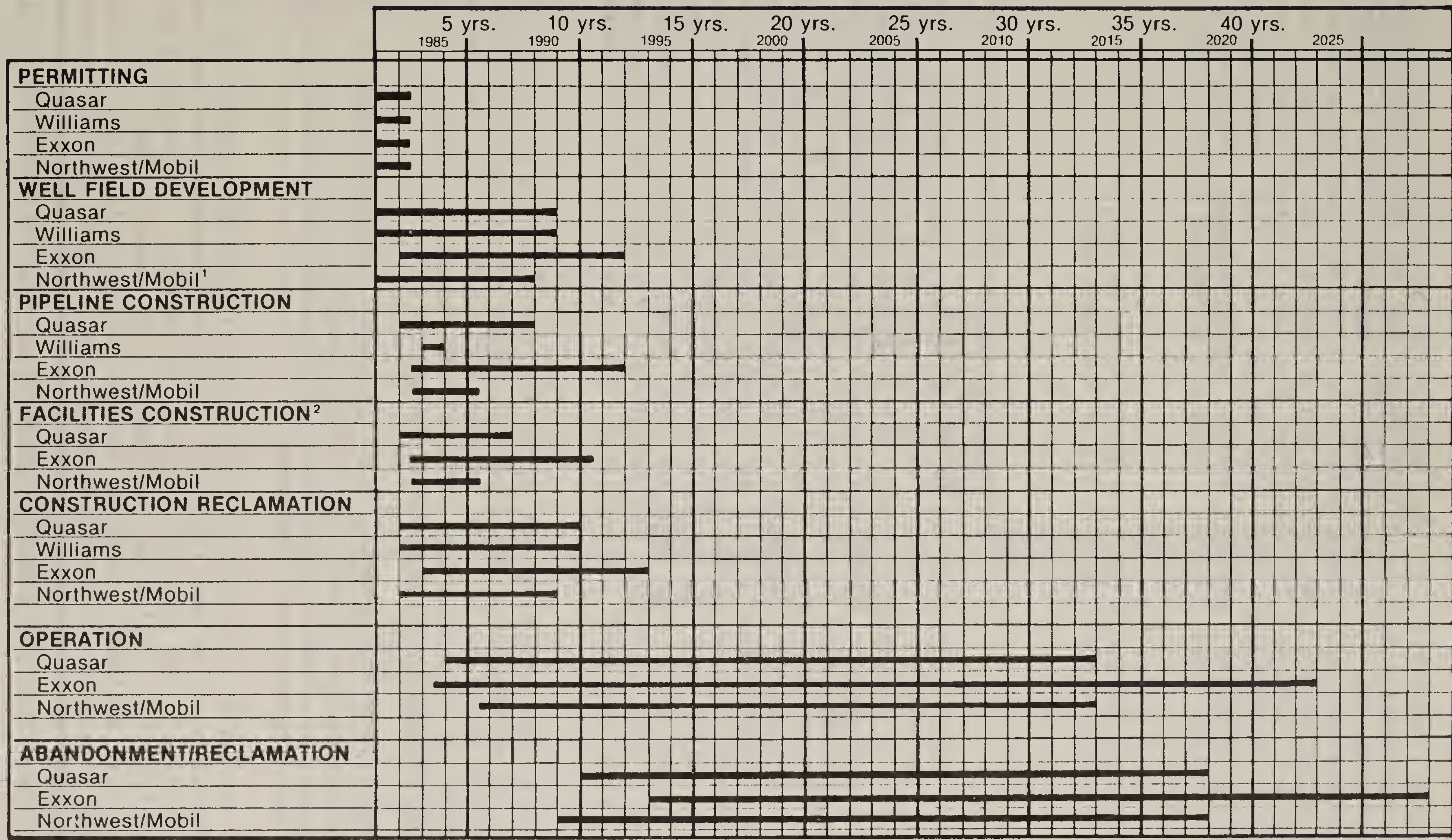
	Participants					
	American Quasar	Williams Exploration	Exxon Corporation	Mobil Oil	Northwest Pipeline	Totals
Well Field						
Units	Riley Ridge, Proposed North Riley Ridge, & Proposed Darby Mountain (supplying Quasar plant)	Sawmill Area (supplying Quasar plant)	Lake Ridge, Fogarty Creek, Graphite, Dry Piney, & Dry Piney Annex (supplying Exxon plants)	Tip Top & Hogsback 0 (supplying Northwest plant)	11	
Total Proposed Wells	72	24	75	67	0	238
Permitted, Drilling, or Completed Wells	5	0	3	5	0	13
Well Field Facilities	-Gathering pipelines -Wellhead facilities including drilling sump pit -Access roads -Communication & transmission lines	-Gathering pipelines -Wellhead facilities including drilling sump pit, dehydration facilities -Access roads -Communication & transmissions lines	-Gathering pipelines -Wellhead facilities including drilling sump pit, dehydration facilities -Access roads Communication & transmission lines	-Wellhead facilities including drilling sump pit -Access roads -Communication & transmission lines	-Gathering pipelines pipelines including drilling facilities -Transmission lines	
Plants						
Proposed Site	East Dry Basin	Will use Quasar's	West Dry Basin & Big Mesa	Will use Northwest's	Craven Creek	4
Alternative Sites	Buckhorn	None	West Dry Basin & East Dry Basin; Shute Creek	None	East Dry Basin	
Capacity	1.2 billion cfd	None	1.2 billion cfd (two plants)	None	400 million cfd	2.8 billion cfd
Product (methane)	240 million cfd	None	252 million cfd	None	84 million cfd	576 million cfd
By-Products	1,960 TPD[1] sulfur 600-700 million cfd CO_2 N_2 He	None	2,240 TPD[1] sulfur 660 million cfd CO_2 N_2 He	None	757 TPD[1] sulfur 260 million cfd CO_2 N_2 He	4,957 TPD[1] sulfur 1,520-1,620 million cfd CO_2

TABLE 1-1 (CONTINUED)

	Participants					
	American Quasar	Williams Exploration	Exxon Corporation	Mobil Oil	Northwest Pipeline	Totals
Plant Facilities	-Above-ground heated sulfur pipeline to Opal[2] -Sour gas line to plant -Access roads, transmission lines, communication lines, water wells -Plant -Sales gas line to Trailblazer Pipeline -CO_2 pipeline		-Above-ground heated sulfur pipeline to Opal -Sour gas line to plant -Access roads, transmission lines, communication lines, water wells -Plant -Sales gas line to Trailblazer Pipeline -CO_2 pipeline	None	-Railroad for sulfur transport to Opal -Sour gas line to plant -Access roads, transmission lines communication lines, water wells -Plant -Sales gas pipeline -CO_2 pipeline	None

[1]Tons per day

[2]Proposed common pipeline with Exxon



[1]Mobil's drilling program would extend to 2009; however, in 1989 the completed 20 wells would be supplying the plant with a maximum 400 million cfd.

[2]Including plants, roads, transmission lines, and railroads.

FIGURE 1-2. RILEY RIDGE PROJECT SCHEDULE

To avoid lengthy repetition in the description of drilling procedures, construction techniques, and facilities operation for each applicant, a detailed description is first presented for American Quasar's proposed components. Thereafter, only those details that differ from those proposed by Quasar are noted for Williams, Exxon, and Northwest Pipeline/Mobil. Data summary Tables 1-2 through 1-12 summarize the land, water, energy, work force, and fill requirements for the project and also summarize the emissions, and solid wastes, sanitary wastes, and waste water which would be generated by the Riley Ridge Project. These are presented at the end of the technical report.

The Erosion Control, Revegetation, and Restoration Guidelines in Appendix B of the Draft EIS would be applicable to all of the companies.

QUASAR

Well Sites

Quasar's Riley Ridge, proposed North Riley Ridge, and proposed Darby Mountain Units (see Map 1-2 in DEIS) would consist of a total of 72 wells, including 2 wells in the Sawmill Area. Drilling dates have been scheduled for 27 wells, and 45 future wells have no present schedule for completion. The 72 wells are scheduled to be developed between 1982 and 1989 (6 wells in 1982; 4 wells in 1983 and 1984; 6 wells in 1985; and 13 wells in 1986 through 1989). A total of nine wells in the proposed Darby Mountain Unit are proposed to be directionally drilled in order to avoid severe access and surface disturbance problems; two wells would be drilled at seven well sites, and three wells would be drilled at one well site. Thus for a total of 72 wells, Quasar would only have 63 well sites. The area prepared at each single well site would be approximately 3.7 acres, while the area prepared at each multiwell directional site would be approximately 7.4 acres.

A maximum of six rigs would be active in the field during drilling. The average number of workers at a drilling rig during normal operations would be 10; the maximum would be 40. The maximum work force in the field at any one time would be approximately 220. Truck traffic during drilling operations would average 12 trips per well per day.

Quasar would utilize existing power lines whenever possible, otherwise new lines would run underground in existing rights-of-way.

Construction, Drilling, and Well Completion

Construction. Gas well drilling would begin by staking the location of the drill pad selected for the drilling rig. The area prepared for each well would be approximately 400 feet by 400 feet (3.7 acres). Preparation would generally involve the following earthwork: an access road would be constructed so that equipment could be brought to the site, the land would be leveled, and a reserve pit would be excavated. Figure 1-3 is representative of a typical drill rig layout and Figure 1-4 illustrates reserve pit construction.

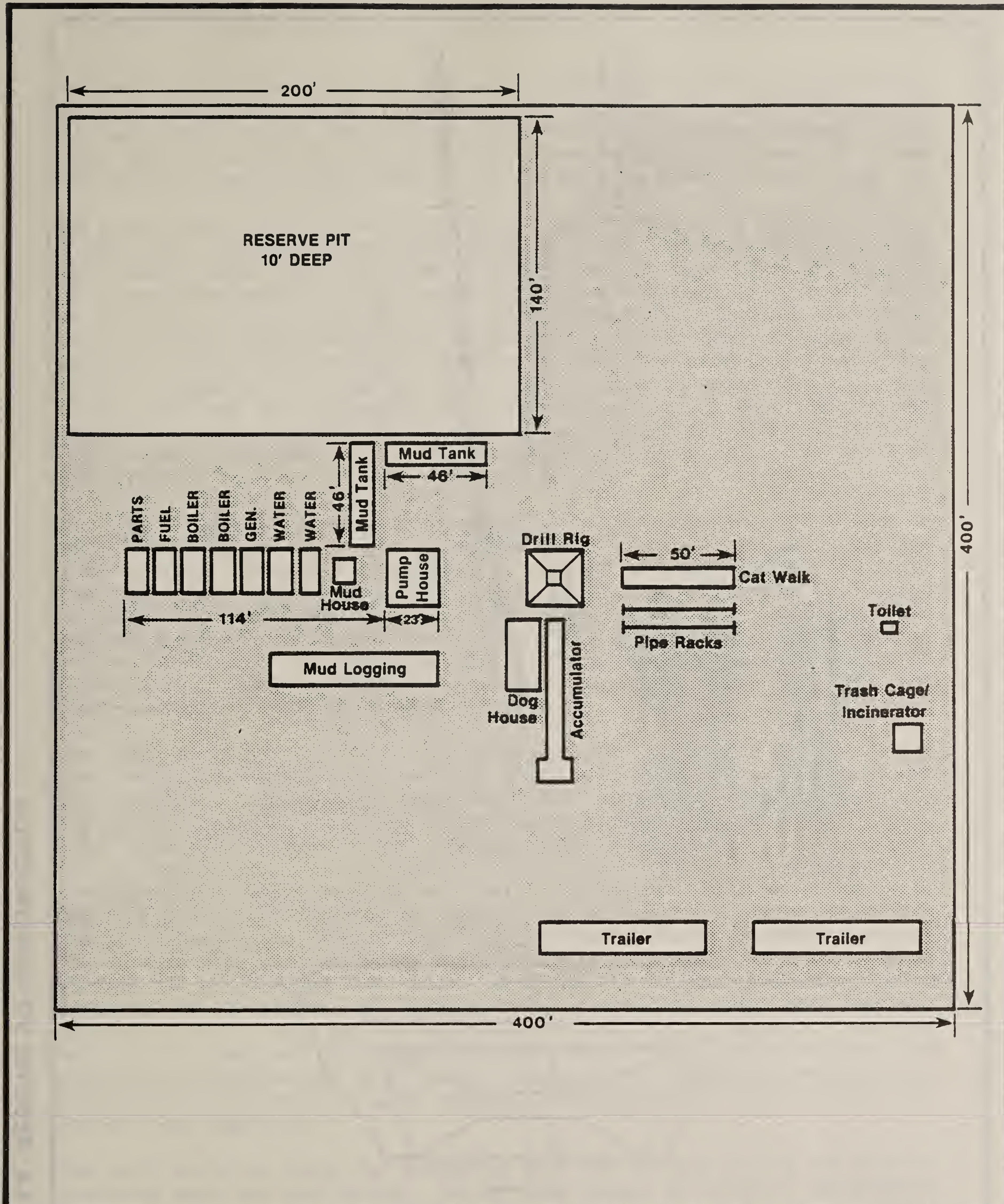
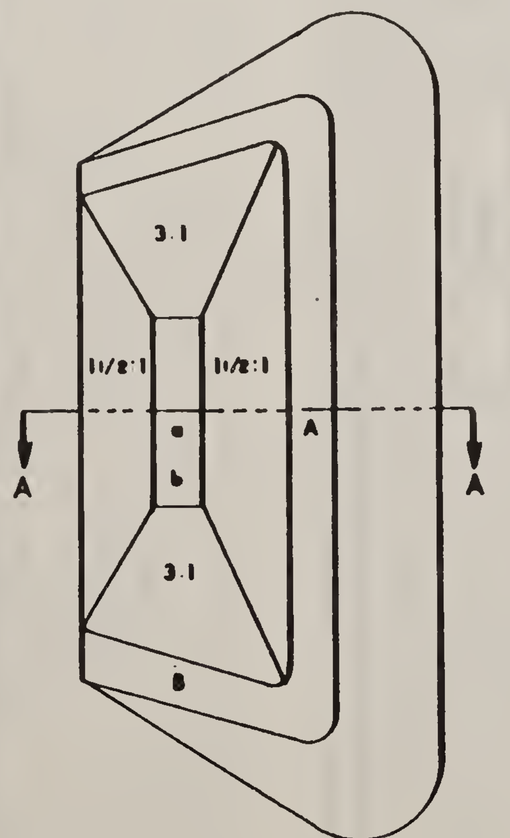


FIGURE 1-3 SCHEMATIC OF WELL SITE DURING DRILLING ACTIVITIES

NOTE:
Volume of Reserve Pit is calculated as V = D/6 AB-ab-(A-a)(B-b). Any dimension may be changed to gain or reduce capacity, 1 acre ft = 1613 cu. yds. = 7760 barrels.

In areas of steep slopes, keyway in section A-A should be excavated and all earthfill layed in 8″ lifts and compacted with equipment travel. As a rule, a minimum of one-half of the pit depth should be in natural ground.



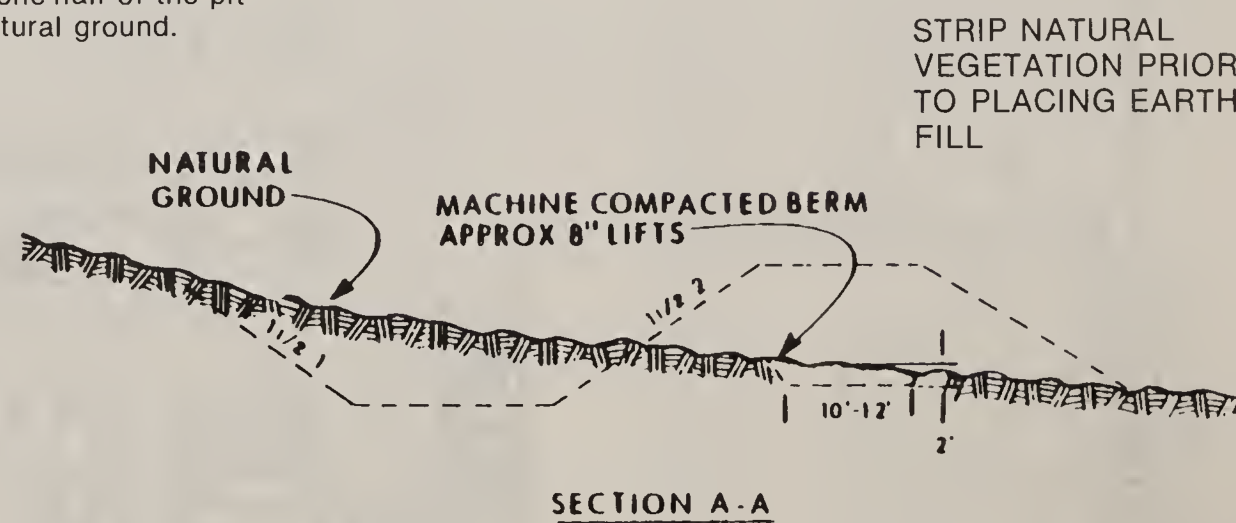


FIGURE 1-4. RESERVE PIT CONSTRUCTION

Mud tanks and unlined reserve pits would contain all fluids used during the drilling operation. The drilling mud would be mixed in steel mud tanks at the well site. Water from surface water sources would be trucked to the site; thus in most cases, no water pipelines would be required. Drilling mud would be trucked to the location in a dry form and mixed with the water.

The basic composition of the drilling mud would be water and bentonitic clay (Table 1-12). Clay increases the viscosity of the drilling fluid to more efficiently remove the formation cuttings from the well bore and forms a thin, semi-impermeable layer of clay particles on the wall of the well bore to minimize the loss of fluid into porous formations. The mud also cools the bit; helps counterbalance any high pressure oil, gas, or water zones encountered; and contributes to drill hole stability. Additional materials could be added to the mud to obtain various desired properties. At the surface the mud is cleaned of rock cuttings which are deposited in the reserve pit, and cleaned mud is recirculated through the hole. Additional mud is mixed to make up for the increased well bore volume as drilling progresses.

Drilling. Following preparation of the site for drilling operations, a small truck-mounted drilling rig would be moved on location to drill a large diameter hole (generally 36 inches) to a depth of approximately 60 feet. Conductor pipe (approximately 30 to 36 inches diameter) would be lowered into the hole and cemented in place with concrete. This conductor would provide a means of diverting the drilling fluids when the surface hole is drilled and would prevent the fluids from invading porous, weathered formations at shallow depths. When the conductor casing is set, the truck-mounted rig would be moved off the site.

The large drilling rig would then be brought in and "rigged up" by raising the derrick and installing wire rope, machinery, pumps, tanks, engines, and other equipment necessary to begin drilling. This would take approximately one week, depending upon well depth and expected downhole conditions. Drilling would then commence on a 24-hour per day basis.

A surface hole would be drilled first to a typical depth of 2,000 feet. Drilling would then commence on 24-hour per day basis. A string of surface pipe or casing would then be inserted into the well and cemented in place. The surface pipe must be of sufficient diameter to enable successive casing strings to be inserted for deeper drilling. A blowout preventer, which consists of a series of hydraulically controlled rams and bag-type mechanisms which could be closed around the drill pipe, would be installed on top of the surface casing (Figure 1-5). This would prevent the uncontrolled release of well bore fluids should abnormal pressures be encountered while drilling. The blowout preventer would remain in use until the well was completed.

The well would be ready for deepening once the surface casing and blowout preventer were set and tested. Two or more stages of borehole advancement and casing installation would be required to complete the drilling operation, depending on hole conditions and total well depth. Intermediate casing would be cemented in place when the hole had been advanced to a predetermined depth below the surface casing. On very deep wells, or wells

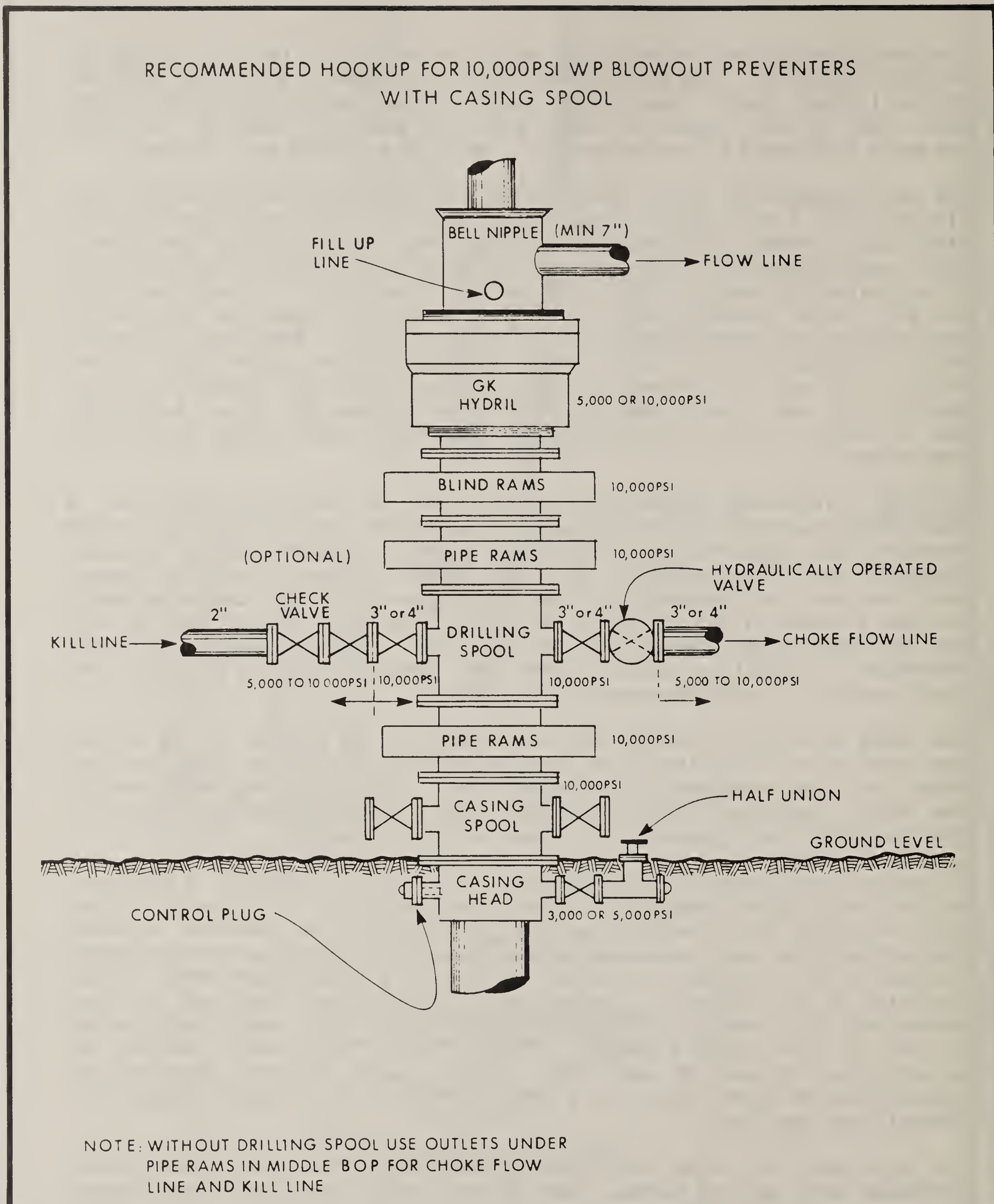


FIGURE 1-5. TYPICAL BLOWOUT PREVENTOR CONFIGURATION (10,000 PSI)

drilled through weak formations which could cause caving in the bore hole, two intermediate casing strings would be put in place. Each successive intermediate casing would be of a smaller diameter and would penetrate deeper than the one preceding it, resulting in a series of telescoping casings.

Bore hole advancement to the total depth would be followed by well evaluation utilizing electrical logs and other evaluation techniques to determine the presence of oil or gas. If the well was determined to be a potential producer, the final string of casing (production casing) would be run into the well and cemented in place in a similar manner to all previous casing strings. At this point, the drilling rig would usually be rigged down and removed from the site.

Well Completion. A workover or completion rig would then be moved in to complete the well. The workover rig is considerably smaller and more portable than the larger drilling rig. The completion operation would be started by placing an inhibitor fluid in the well bore to prevent corrosion of the well casing. The remaining drilling mud removed from the well would be discarded into the reserve pit.

Completion operations would continue by perforating the casing adjacent to the production zones identified on the previously run electrical logs. A production packer (a device used to isolate the downhole pressure) would be set above the perforated interval and tubing would be run into the well. The tubing is a small diameter string of pipe which would be run inside the production casing to transport the produced gas to the surface.

The well would then be acidized with hydrochloric acid (approximately 10,000 gallons of 15 percent HCl per well) to provide efficient communication of gas from the formation to the well bore. Flow tests along with pressure monitoring would be conducted to determine the well potential and productivity. Upon well completion, the rig would be removed and the drill site would be cleared. The well would then be connected to the gathering system and placed on line. The time required for the entire well installation would be about 240 days (including 60 days for completion); the average life span of a typical well would be 20 years.

Wellhead Operation and Abandonment

Operation. Construction of production facilities would begin after the drilling operations are completed on a given well. Quasar's facilities at a typical production well would include a wellhead, a gas/water separator, a metering system, an electrical system and injection system, a storage tank for corrosion inhibitor chemicals, and a gathering line leading to the production network (see Figure 1-6). Individual wellhead production facilities would perform four basic functions: (1) injection of a corrosion inhibitor into the well; (2) separation of water from the production stream; (3) metering of the production; and (4) recombining the water with metered production downstream of the wellhead measurement facility. Gathering lines would transport the water-production mixture from the well site to the treatment plant where all water would be separated from the gas and disposed.

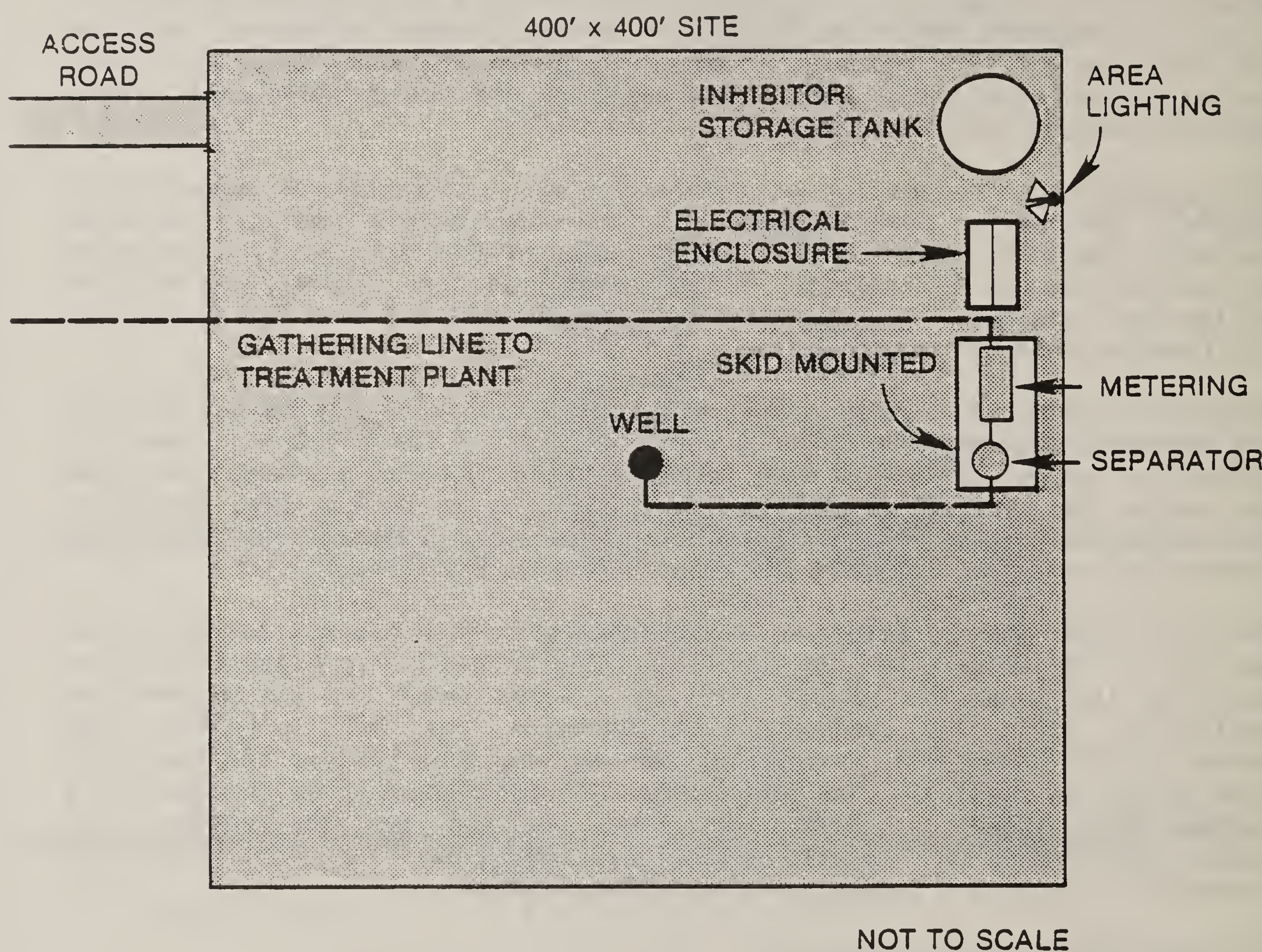


FIGURE 1-6 TYPICAL WELL SITE DURING OPERATION

Each wellhead facility would be served by an electrical system for powering corrosion inhibitor injection pumps, area lighting, well control systems, and measurement data systems. The production wells would require a three-phase, 230- or 460-volt system. A 10-horsepower motor (860 watt/HP) would run the chemical injection pump, and there would be two 400-watt flood lights, resulting in a total requirement of 9,400 watts per well. Any necessary power cables would be buried coincident with the gathering lines. There would be no water requirements at the well sites during operation.

The maximum number of people on-site during production operations would probably occur during the early phases of the project when both production and completion crews would be active. A nine-person crew is anticipated for the supervision of production, and two chemical personnel would monitor the continuous inhibitor injection system within the gas field at all times. Completion rigs would be operated by two crews of five persons each. This work force would be adequate for operation and maintenance of pipeline systems as well. During special procedures such as stimulation of a well, the work force could increase by 50 persons; such procedures normally last for a period of one to two days.

Continuous chemical injection is proposed for each well site, requiring bulk chemical trucks in the field to maintain the chemical storage at each well. Truck traffic would average three trucks per day to each well. Roads would be kept passable during most of the year by snow removal, grading, and applying gravel where necessary. During periods of heavy snow cover, tracked vehicles would be used to travel between sites.

The operation and maintenance of the production wells would not generate significant quantities of waste. Water entrained in the production stream would not be collected at the well site, but would be separated and collected at the treatment plant. Any wastes that are generated during normal maintenance of the well sites would be removed from the site and taken to an approved landfill.

Well field emissions would result primarily from initial well drilling, which employs diesel-fired drilling rigs. Quasar's total estimated emissions from the Riley Ridge Project are provided in Table 1-9.

The operation and maintenance phase of the project would entail fewer potentially hazardous processes than the drilling operations; however, during the use of heavy equipment and other well site maintenance activities, precautions would be taken to assure safety to personnel and property. The lease operators would inspect each well site a minimum of twice per day in order to monitor production and check the operation of the equipment at each well. Any minor maintenance would be performed by the lease operators.

Abandonment. A well that stopped producing or was found to be dry upon completion of drilling would be plugged and abandoned. The first stage in the abandonment process would be to install a cement plug at the bottom of the production casing and to force cement into the adjacent formations through perforations in the casing. The tubing string would then be

removed, and cement plugs would be placed at designated depths in the well to prevent migration of water or hydrocarbons and to protect any potential fresh water aquifers from contamination in accordance with applicable state and federal regulations.

Since all casings would be cemented in the borehole, no casing would be recovered from the well. The wellhead and casing would be cut off below ground level and capped with cement. A dry hole marker would identify the company name, date, and legal description.

All above-ground facilities, foundations, and salvageable materials would be removed. Soil material would be restored over the well and the site returned to its original contour as soon as the well abandonment was completed. Each completed well site would be reseeded by the next growing season using techniques and methods described in the Erosion Control, Revegetation, and Restoration Guidelines (Appendix B of the Draft EIS).

Waste Disposal

The mud tanks and reserve pits would contain all fluids used during the drilling operation. The mud tanks would be constructed of steel and would be on-site only during the drilling operations. The reserve pit would handle all mud which was discarded during and at the conclusion of the drilling process. The mud would contain water, mud additives, and formation cuttings. At the conclusion of the drilling operation, the reserve pit would remain uncovered until the water had evaporated, leaving only solids in the base of the pit. If evaporation is slowed by weather conditions, the liquid contents of the pit would be pumped out and hauled to an approved disposal site. At that point, the pit would be backfilled and recontoured as necessary.

Fluids produced during testing operations on the well would be collected in a test tank on the site. No discharge of fluids from the site would occur without prior approval of the appropriate agencies.

Solid wastes generated during drilling operations and testing would be predominantly composed of paper drilling mud sacks and other cardboard containers. These wastes would be incinerated as approved by the regulatory agencies (incinerators would not be approved on National Forest lands) or trucked to an approved sanitary landfill. At the conclusion of the drilling operation, or as needed, ash would be removed from the incinerator and placed in an approved sanitary landfill. Non-combustible wastes would be placed in a sanitary landfill. Any scrap metal would be sold to a recycling firm. Sewage would be handled according to state sanitary codes both during and after drilling operations.

At the conclusion of drilling operations, all sewage and waste would be removed from the site and taken to an approved sewage treatment plant or sanitary landfill removed from the site. Estimated solid wastes, sanitary wastes, and waste water generated by Quasar are included in Table 1-10.

Safety

Drilling and completion operations would involve potentially hazardous equipment and processes. By following safety procedures and using equipment

designed specifically for drilling operations, it should be possible to avoid most hazardous situations. Drillers, equipment operators, and other contractors, as well as company personnel, would be familiar with all safety procedures and equipment. The primary hazard to human life and property would be the danger of toxic (H_2S) and/or explosive gas (CH_4) releases from the well during drilling.

Precautions by the toolpusher, drill crew, and mud engineer would be necessary to avoid potential risks both from slow gas seepage from the well and from well blowouts caused by abnormally high gas pressure zones. Blowout preventers would be installed on all wells prior to drilling out the surface casing. Pressure tests on the blind rams, pipe rams, and manifolds would be conducted at this point, and every 30 days thereafter. The blowout preventers would be inspected at least daily; all inspections would be recorded in the daily logs. Preventers would also be pressure tested prior to drilling out of any intermediate casing.

Complete awareness by the drilling crew and maintenance of proper mud fill in the borehole would be instrumental in preventing a gas kick from becoming a blowout during drilling operations. During normal drilling through a known gas-producing zone, mud weights would be carefully controlled and an H_2S scavenger (zinc chloride) would be added to the mud. Gas detectors and other warning and safety systems would be used on the site.

Other safety problems on the site could result from open excavations and fire. Fire hazards would be reduced by following precautionary procedures and by installing the necessary equipment on site. Fire hand tools would be made available to site personnel.

Traffic hazards resulting from travel to and from the site would be reduced through precautionary measures. Warning vehicles would accompany mobile heavy equipment on roads used by the public; signs would be installed warning the public of equipment operation areas. Traffic on access roads could be reduced by carpooling crews to and from the site.

Required Resources

Water, fuel, and fill requirements for Quasar's drilling operation are summarized in Tables 1-5, 1-6, and 1-8. Water required for drilling would be hauled from the nearest available surface water source.

Gravel would be used for road and site surfacing material when required. Riprap would be used, where necessary, for slope protection at culverts, creek crossings, and other construction sites. These materials would be obtained from the access road right-of-way, from local commercial suppliers or landowners, or from nearby public lands. Suitable materials found in construction excavations would be used whenever possible.

Well Field Access Roads

The proposed well field roadway system is summarized in Table 1-11. Access roads would be constructed to each well site using existing roads wherever possible. New roads would be designed to minimize additional disturbance. Present plans by Quasar call for an estimated 79 miles of access roads (new and improved) requiring a 30-foot right-of-way width. The disturbance area should not exceed 30 to 35 feet for permanent roads.

The major activities for road construction would be clearing, topsoil stripping, excavation, construction of drainage ditches and drainage structures, surfacing, cleanup, and restoration of cut and fill slopes. The right-of-way would be excavated and compacted until a suitable, stable, roadway of the proper width is constructed. The fill would be compacted with suitable equipment. Moisture would be added, if required, to obtain adequate compaction. Where adequate surfacing material is not present, gravel would be applied to the roadway to prevent the road subbase from failing under the superimposed loads.

Gathering System

In addition to rights-of-way across public lands, easements across private lands would be purchased through negotiations between the applicant and owners of affected private lands or mining claims prior to initiating surveying and construction-related activities. Owners, tenants, and leasees of public and private lands in the right-of-way would be notified prior to construction activities which could affect their property, business, or operations. Notification to private landowners or tenants would be made by personal visit or mail a few days before the start of construction. Prior to construction, ranchers would be advised of fence openings, disturbances to range improvements, or other range-use related activities.

Pipe sizes used in the gathering system would range from 6 inches to 26 inches in diameter. Trunk lines could range from 28 to 36 inches in diameter. The proposed rights-of-way would be 50 feet wide. Construction activities would be confined to this right-of-way along most of the length of the proposed gathering line, trunk line, and sales line. Only those portions of the right-of-way needed for construction would be cleared of obstacles and debris. Typical construction activities are schematically shown on Figure 1-7.

Construction activities would require clearing above-ground vegetation and obstacles from an average 30-foot wide portion of the right-of-way to allow for safe and efficient operation of the construction equipment. Blading of the right-of-way would only be done if necessary for access for machinery and equipment, or for the trenching required for the installation of pipe. For instance, it is sometimes necessary to blade in areas with steep sideslopes. Due to terrain or proximity of existing utilities, there may be some areas where more than a 50-foot width may be needed. In these cases, a Temporary Use Permit may be needed for construction of a wider right-of-way.

To further ensure vehicle safety, it may be necessary to construct temporary bridges or culverts across creeks and arroyos on the working side of the right-of-way. Where temporary bridges or culverts are necessary, fill materials would be obtained either from the right-of-way, commercial sources, or authorized borrow sites on public or private lands. Grading and cut-and-fill excavation would be performed to minimize effects on natural drainage and slope stability. Surplus surface soils would be handled in a manner to avoid blocking natural drainages. On steep terrain or in wet areas where the right-of-way must be graded at two elevations, or where diversion dams must be built to facilitate construction, the areas would be restored upon completion of construction to resemble their original

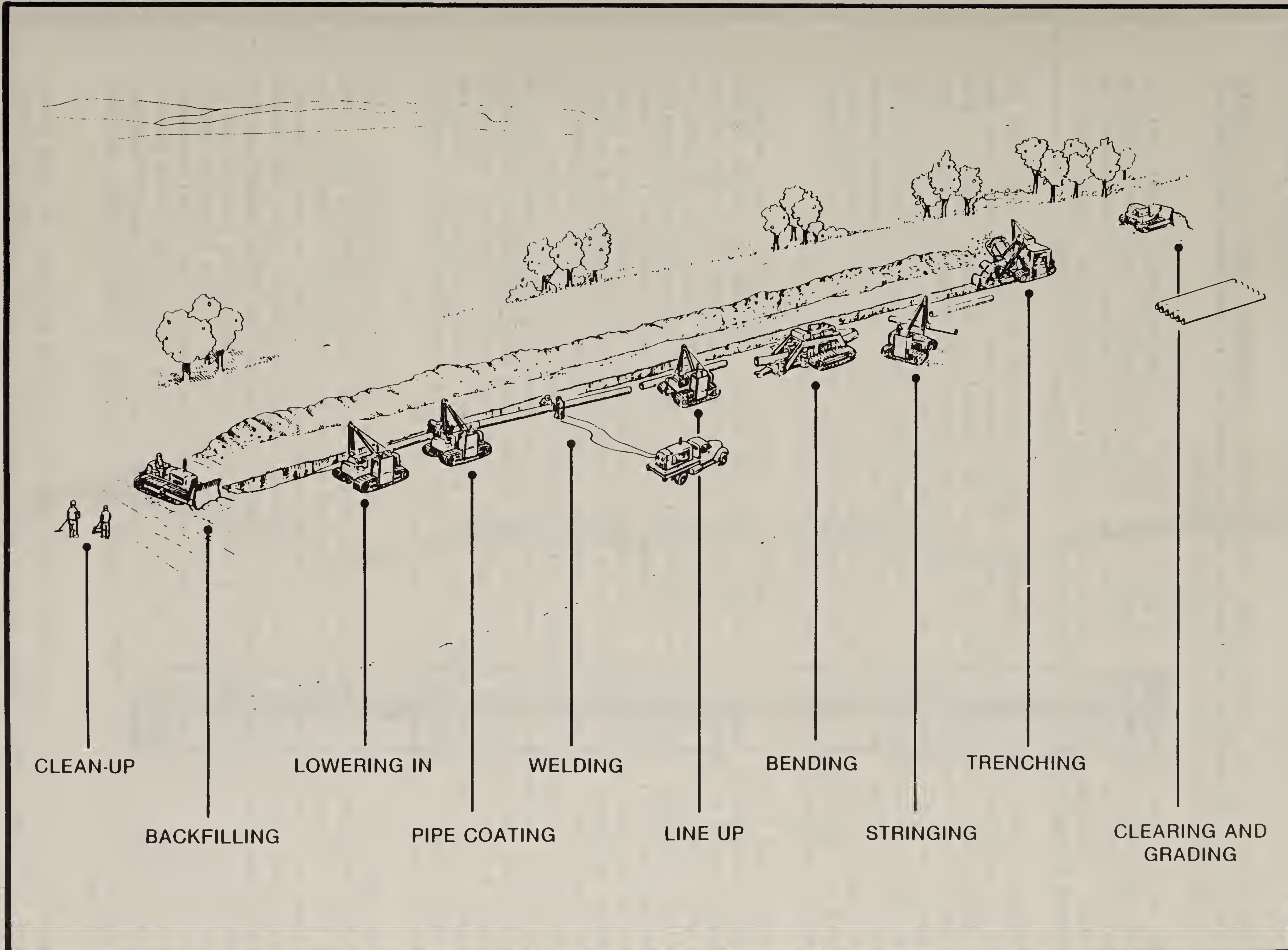


FIGURE 1-7 TYPICAL PIPELINE CONSTRUCTION SPREAD

condition, or as required by the surface management agency or private landowner. Excavation and grading may be necessary to decrease the gradient and increase the stability of unstable slopes.

At major river crossings, cleared working areas approximately 100 feet by 350 feet would be needed on each side of the crossing. The river crossing points would be carefully selected to minimize disturbance of riverbeds or banks. Working areas of approximately 100 feet by 350 feet would also be needed on each side of road, railroad, and minor river crossings.

Storage areas required for equipment, pipe, and other materials would not be on or adjacent to the right-of-way. Where fences are encountered along the right-of-way, adequate bracing would be installed at each edge of the right-of-way prior to cutting the wires and installing temporary gates. The opening would subsequently be controlled as necessary during construction. No gates or cattleguards on established roads over public land would be locked, blocked, or closed by the applicant. Any cattleguard damaged would be repaired to its original condition or replaced. If a natural barrier used for livestock control were damaged during construction, the applicant would adequately fence the area to prevent the escape of livestock.

Once the right-of-way is prepared, ditching, stringing, and welding operations would begin. A ditch, 18 to 48 inches wide and 36 to 66 inches deep, would be centered on a line about 15 feet away from one edge of the right-of-way, thus providing about 35 feet of working space and an area in which to place ditch-excavated materials. The ditch would be excavated mechanically with ditching equipment. The ditch of each construction spread would be open no more than 7 miles and for no more than 14 days at a time. Where necessary for livestock or wildlife crossing, dirt plugs would be left in the ditch. In areas where loose or unconsolidated rock is encountered, the ditch would be excavated using backhoes and clamshell buckets. An exception to mechanical excavation would be hand-digging to locate buried utilities such as other pipelines and cables, and blasting where necessary. Where buried utilities are encountered, representatives from the utilities would be consulted regarding the proposed route of the pipeline right-of-way. Construction activities would proceed with special precautions to prevent damage to buried utilities.

The depth of the ditch would vary with the conditions encountered. The cover from the top of the pipe to the ground level would generally be 2.5 to 5 feet. However, in areas where rocks would be removed by blasting, the cover would be 24 inches in populated areas and 18 inches in open country. Occasionally, the ditch would be excavated to depths greater than the stated minimums. For instance, when the pipeline traverses specific locations for which there would be definite plans to level the land, the pipe would be buried at a depth that would accommodate these plans. When crossing canals or irrigation ditches that are dredged to maintain depth, the pipeline would either span overhead or be buried underneath to a depth that would permit safe dredging operations. At railroad and road crossings, specifications require a minimum of 3 feet of cover over the pipe in the drainage ditches (Figures 1-8 and 1-9).

Generally, ditching operations would employ ditching machines in open areas and backhoes near rivers or in areas providing little working space;

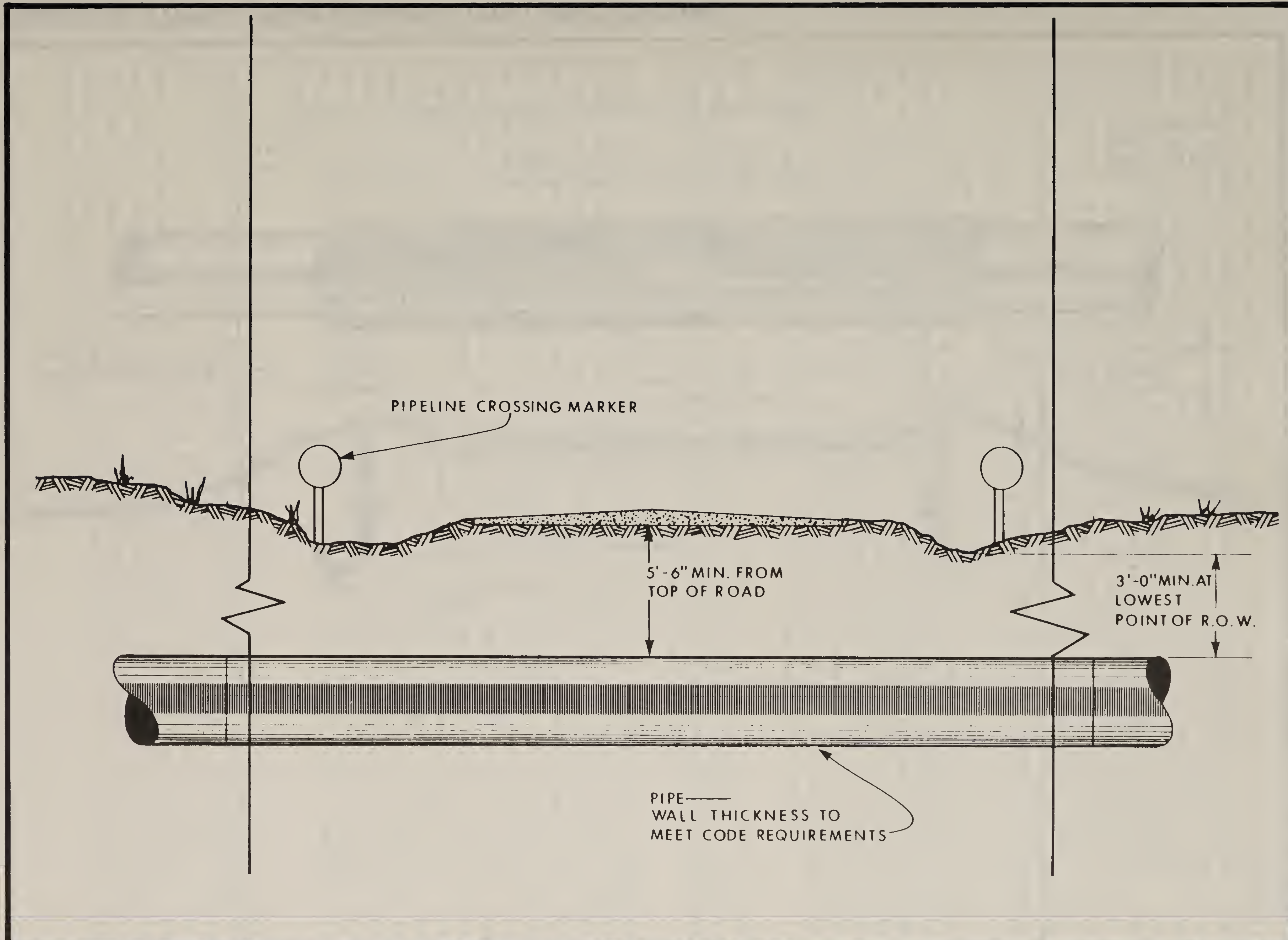


FIGURE 1-8. TYPICAL ROAD CROSSING FOR UNCASED PIPELINE

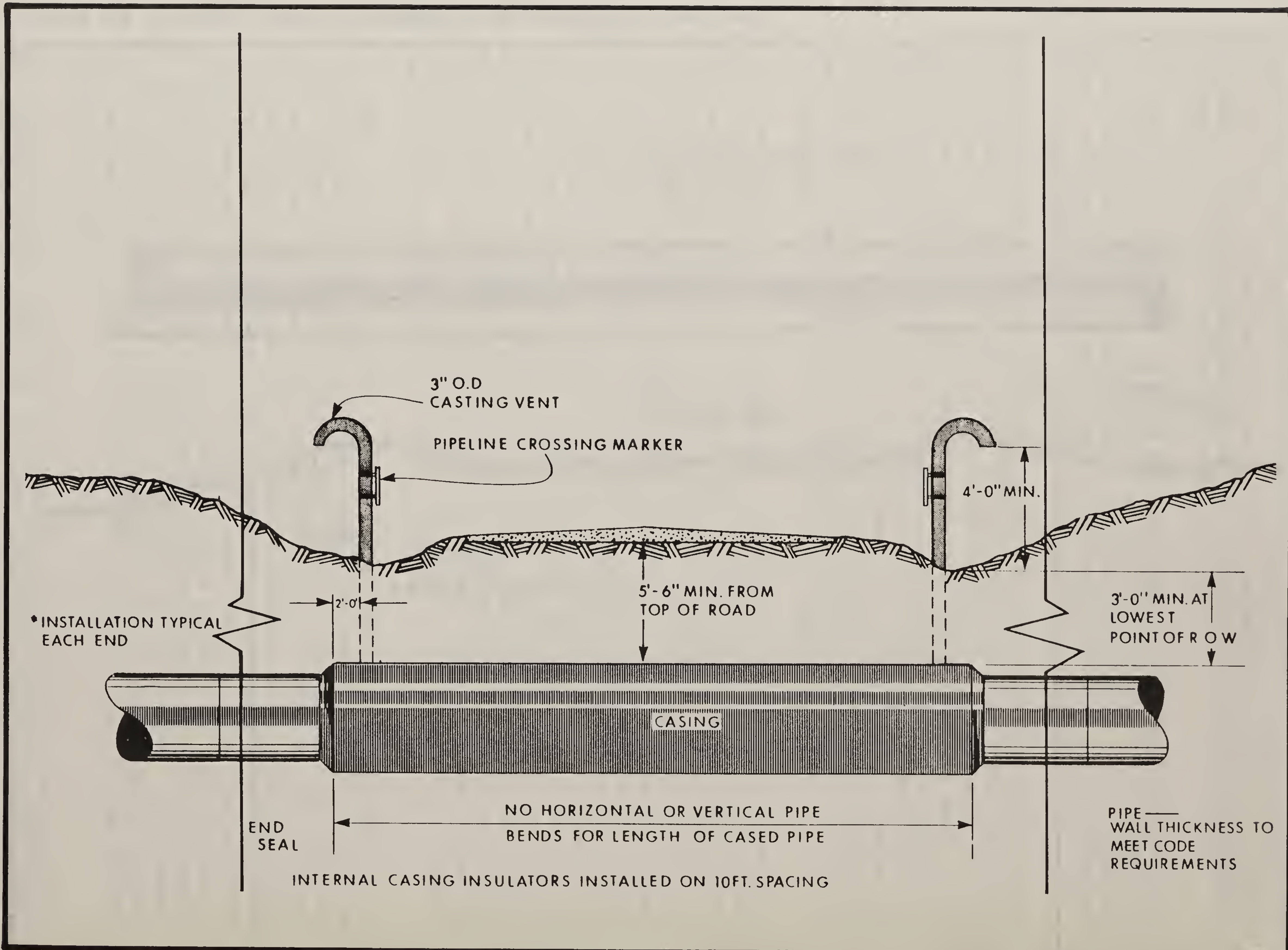


FIGURE 1-9. TYPICAL ROAD CROSSING FOR CASED PIPELINE

however, subsurface conditions may require different types of excavation. In areas where loose or unconsolidated rock is encountered, the ditch line may be ripped mechanically. This process would involve a tractor dragging a long shank (ripper-tooth) behind it to dislodge the material. If the material encountered could not be ripped, it would be blasted. In preparation for blasting, unconsolidated material would be removed from the ditch line, and a series of holes would be drilled by air-powered drills. Air-powered drills are normally suspended from a side-boom tractor (twin drills) which also tows the compressor that supplies the air. Self-propelled drills (air-track) may be used if a significant amount of drilling is required in one location. Blasting would be kept to a minimum and used only when necessary.

Figures 1-10 and 1-11 illustrate a profile and plan for a typical river crossing. Normally, construction of crossings would be accomplished within two weeks. River crossings would not be affected during periods of high flow (usually late spring). The ditch would be excavated to the depth that minimizes the effect of scour action to the pipeline during periods of high flow. The pipeline in the streambed would be beneath the maximum scour depth. The minimum cover would be 4 feet, or 20 percent of the distance of maximum scour (whichever is greater), beneath the maximum scour depth.

During construction of river crossings, the drainage or storm runoff from riverbank staging areas would be controlled via detention basins, evaporation pits, or straw bale filters to ensure that levels of suspended solids, grease, or oil would not exceed receiving water standards.

Creek flow would be maintained during pipeline construction. Whenever possible, crossings would be made during periods of low flow. The original creek gradient would be maintained upon completion of construction. When crossng creeks with muddy bottoms, downstream sedimentation would be minimized by implementation of the following techniques: (1) Creeks flowing in areas where the channel is narrow would have the flow diverted around the construction area by blocking the channel upstream of the crossing site and diverting the flow through the use of pumps and/or flumes; (2) Creeks flowing in relatively flat areas where the channel is wide would have the flow diverted around the construction area by blocking a portion of the channel upstream of the crossing site. After construction is completed in that portion of the channel and the creek bottom is restored, then that portion of the channel would be reopened and another portion blocked for construction. This procedure would be repeated until the crossing is completed.

Normally, the ditch would be graded on each approach to the river so that the sag bend would be a minimum of 20 feet back from the top of the banks of the river to minimize potential exposure of the pipe at the banks. Every effort would be made to minimize the effects of construction on water flow. Upon completion of construction, the gradient of the stream would be restored as nearly as practical. Stream banks would be restored to resemble original grade, and breakers or riprap would be placed along riverbanks where necessary to control erosion. The pipeline would be weighted with concrete to offset its buoyancy.

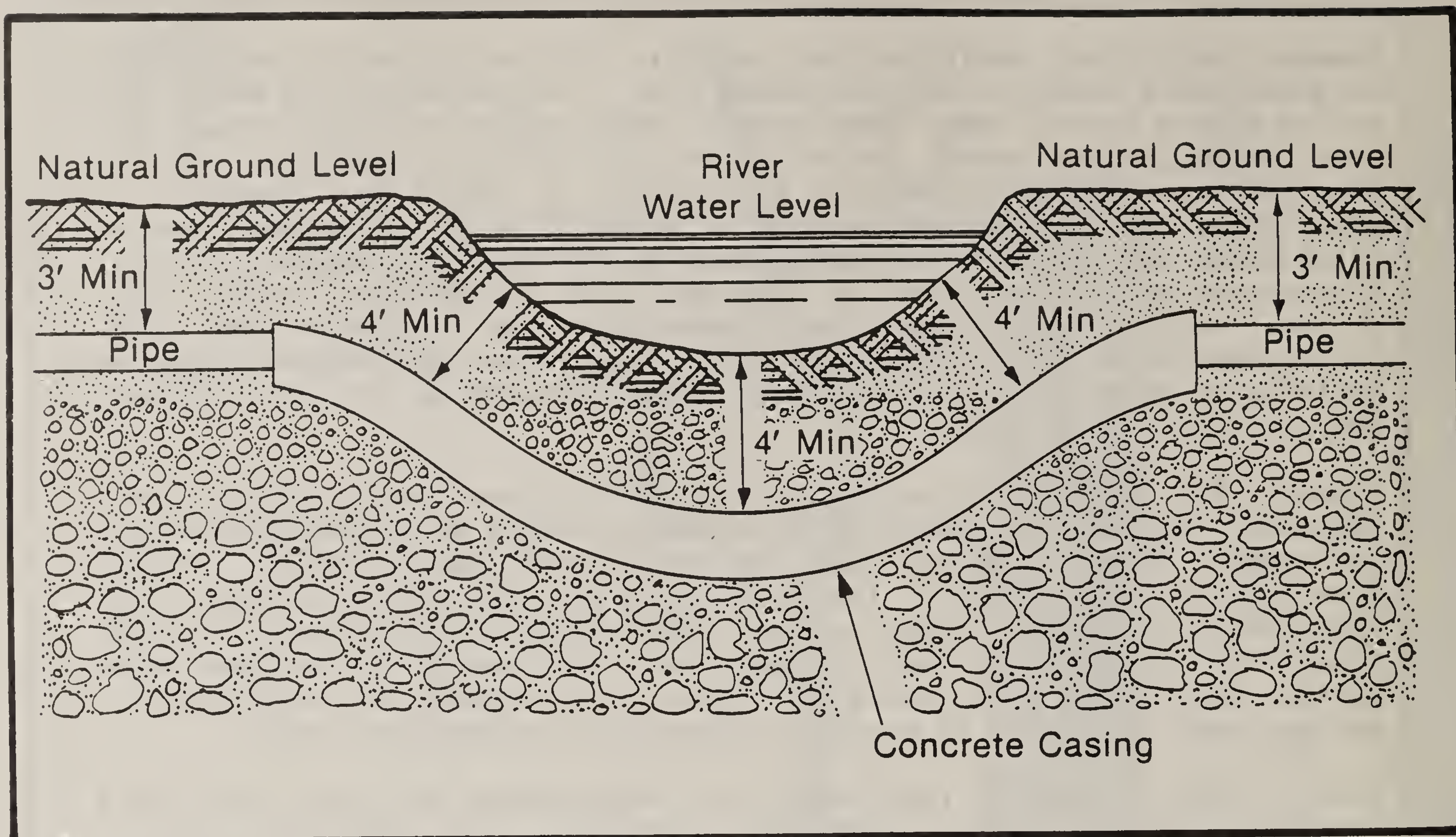


FIGURE 1-10 TYPICAL PROFILE FOR PIPELINE RIVER CROSSING

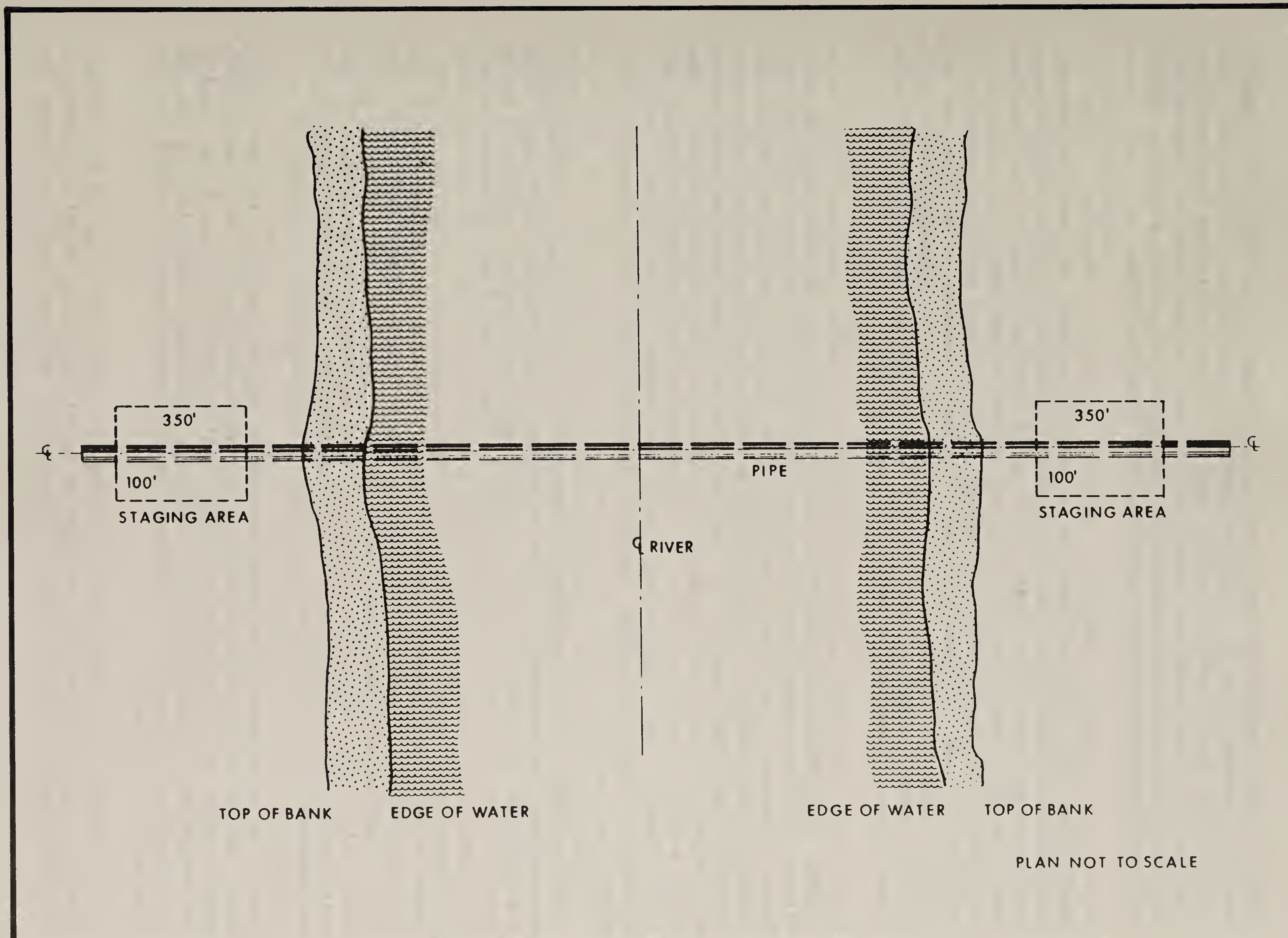


FIGURE 1-11. TYPICAL PLAN FOR PIPELINE RIVER CROSSING

Roadbeds that support railroads would be crossed by boring a hole beneath the bed, rather than by ditching across the surface. Casing would be installed at these roadbeds and at road crossings only where they would be required by federal, state, local, or railroad authorities. All paved and improved roads would be crossed by boring if traffic volume was high. Other rarely used, unimproved roads would be ditched and restored.

Ditching, stringing, bending, welding, coating, lowering, tying-in, backfilling, and cleanup are the usual steps that follow right-of-way preparation (Figure 1-7). The pipe would be placed along the right-of-way, bent where necessary, and welded. It would then be coated with protective materials for protection from external corrosion and lowered directly into the ditch. In rocky areas, the bottom of the trench would be padded with sand or soil to protect the coating and to provide a uniform bearing surface. Once it is placed in the ditch, the pipe would be padded with soil, or where necessary rock shield may be used in place of padding to protect the pipe coating during backfill operations.

Backfilling operations would be conducted in a manner designed to minimize further disturbance to vegetation. Backfilling over the pipe would be done with a bulldozer which would compact the fill, thus reducing settling. Where necessary for ground stability, the backfill would be graded and compacted by tamping or walked-in with a wheeled or track vehicle. Once the ditch has been backfilled, the right-of-way and other disturbed areas would be cleared of trash, brush, and other debris to prevent fire hazards. Some brush would be used to assist in stabilization and rehabilitation of the right-of-way. The right-of-way would be graded where needed, and all disturbed surfaces would be restored approximately to the preconstruction grade.

After backfilling is completed, a hydrostatic test would be conducted to detect leaks or weaknesses in the pipeline. This would be done by filling the pipeline with water from a surface water source and holding it at a specified pressure for a given length of time. The amount of water needed for hydrostatic testing Quasar's entire pipeline system is estimated to be 28.1 acre-feet which includes both the sales and gathering systems. Quasar's proposed gathering system expansion in 1986 and 1987 would require approximately 0.05 and 0.08 acre-feet, respectively (see Table 1-5). To help conserve water and lessen environmental impacts during the disposal of hydrostatic test water, the pipeline would be tested in sections, and the water would be moved from one section to the next. This would reduce by an estimated one-half, the quantity of water needed for hydrostatic testing.

Since the interior of the pipelines would not be coated, the test water would contain iron oxide as well as stream sediments and small amounts of welding slag, oil, and grease. Normal testing conditions would not require the addition of chemicals. If schedule problems cause testing to be conducted under freezing conditions, an antifreeze would be added to the test water as necessary.

After completion of hydrostatic testing, the test water would be removed from the pipe, filtered, and released as specified by the Wyoming Department of Environmental Quality (DEQ). DEQ usually requires that test water be

discharged into pits where the water evaporates or percolates into the soil (these pits must be reclaimed); however, DEQ may allow test water to be discharged into dry stream beds or gullies where the water would not come in contact with live streams. Energy dissipators are used to minimize bank cutting and excessive erosion. Specific measures to protect water quality, stream life, and downstream uses are specified by DEQ when permission to discharge is granted.

Completed construction areas (including the right-of-way) and temporary access roads would be returned as nearly as practicable to the original condition or to that condition agreed upon between the applicant and the landowners or the authorized officer of the applicable agency. Restoration of areas disturbed by pipeline construction would be accomplished by means most suitable for the soils, terrain, climatic conditions, and surrounding vegetation (Appendix B of the Draft EIS). Right-of-way restoration techniques would be the same for federal, state, and private lands. Low-growing shrubs which would not interfere with the pipe would be allowed to grow on the rights-of-way.

All reasonable efforts would be made to control erosion and soil damage resulting from construction, rehabilitation, or maintenance and operations, including (but not limited to) construction of terraces, water bars, or other water diversion structures, and implementation of soil stabilization measures in erosion-prone areas. Routine aerial reconnaissance flights would continue for the life of the project to check for erosion problems and revegetation success along the pipelines.

The initial phase of construction of Quasar's gathering pipeline system, including the sour gas trunk line and the CO_2 sales pipeline, would be accomplished by two crews working simultaneously. Similar crews would be required for the other pipelines. One crew would employ 350 workers and the other about 190. Pipeline construction would average 1 mile per day in smooth terrain and 0.5 mile per day in rough terrain. Estimated construction time would range from 4.5 to 6 months.

Safety block valves would be located at appropriate intervals along the pipeline alignments. The block values are sensitive to pressure loss (indicative of line rupture), and any change in pressure would cause the valves to close. Any power loss would also initiate automatic closing.

At abandonment, all well field pipelines would be purged of sour gas or other contaminants. Underground pipelines would be sealed and abandoned in place. Unsalvageable materials would be disposed of at an authorized disposal site. Disturbed areas would be regraded and revegetated according to the Erosion Control, Revegetation, and Restoration Guidelines (see Appendix B of the Draft EIS). The construction and erosion control and restoration procedures for sales gas and CO_2 pipelines would be the same as that described for the gathering system pipeline.

Treatment Facilities

Each treatment plant would consist of the following components:

- treatment plant modules
- dehydration system (Quasar only)
- power line
- access roads
- sales gas pipeline
- waste disposal
- water supply
- ancillary plant facilities

Treatment Plant Modules

Quasar's plant site at East Dry Basin would include a maximum of six unitized gas treatment modules, each capable of processing 200 million cfd of sour gas. A single module would occupy approximately 37 acres, and a total of 222 acres would be needed for all six modules. An additional 40 acres would be used for sulfur storage and 378 acres for a buffer zone. The total amount of land to be leased for the plant site would be 640 acres. Figure 1-12 shows a typical 200-million cfd production module within Quasar's 1.2-billion cfd gas treatment plant. A more detailed description of each processing unit in the gas treating module is discussed in the subsections that follow.

Gas Separation. The Selexol process is a proprietary physical absorption gas sweetening process licensed by Norton Company. The process has been used extensively by more than 50 engineering contractors. Seloxol solvent (dimethyl ether of polyethylene glycol) has a very mild odor and is non-toxic. The Selexol process is currently favored over other sweetening processes for the following reasons: high selectivity for CO_2 and H_2S, fewer associated corrosion problems, lower circulation requirements for feedstreams containing little or no ethane and heavier components, ability to handle a wide range of feedstream compositions, and proven commercial performance.

The process flow diagram for a typical two-stage Selexol unit is shown in Figure 1-13. In this process H_2S is first selectively removed by the absorbent and then released in a steam stripper as a concentrated feed gas to the sulfur recovery process. In the second step over 90 percent of the CO_2 is removed from the CH_4, N_2, and other inerts by the absorbent. The CO_2 is subsequently released from the absorbent by flashing and N_2 stripping. The CH_4/N_2 medium-Btu overhead gas stream from the CO_2 absorber contains approximately 4 parts per million H_2S and 27 percent N_2. This stream flows under high pressure to the Nitrogen Rejection Unit (Figure 1-14) where water is removed in molecular sieve dehydrators. The gas is then expanded to reduce the temperature and permit separation of the N_2 and inerts from the CH_4 product. Current plans call for venting of the N_2 stream. The CH_4 stream will be compressed and sold as pipeline-quality natural gas.

Sulfur Recovery. A Claus unit or a similiar type of process would be used to convert the H_2S in the Selexol stripper off-gas into sulfur. In a typical Claus process (Figure 1-15), part of the acid feed gas flow is

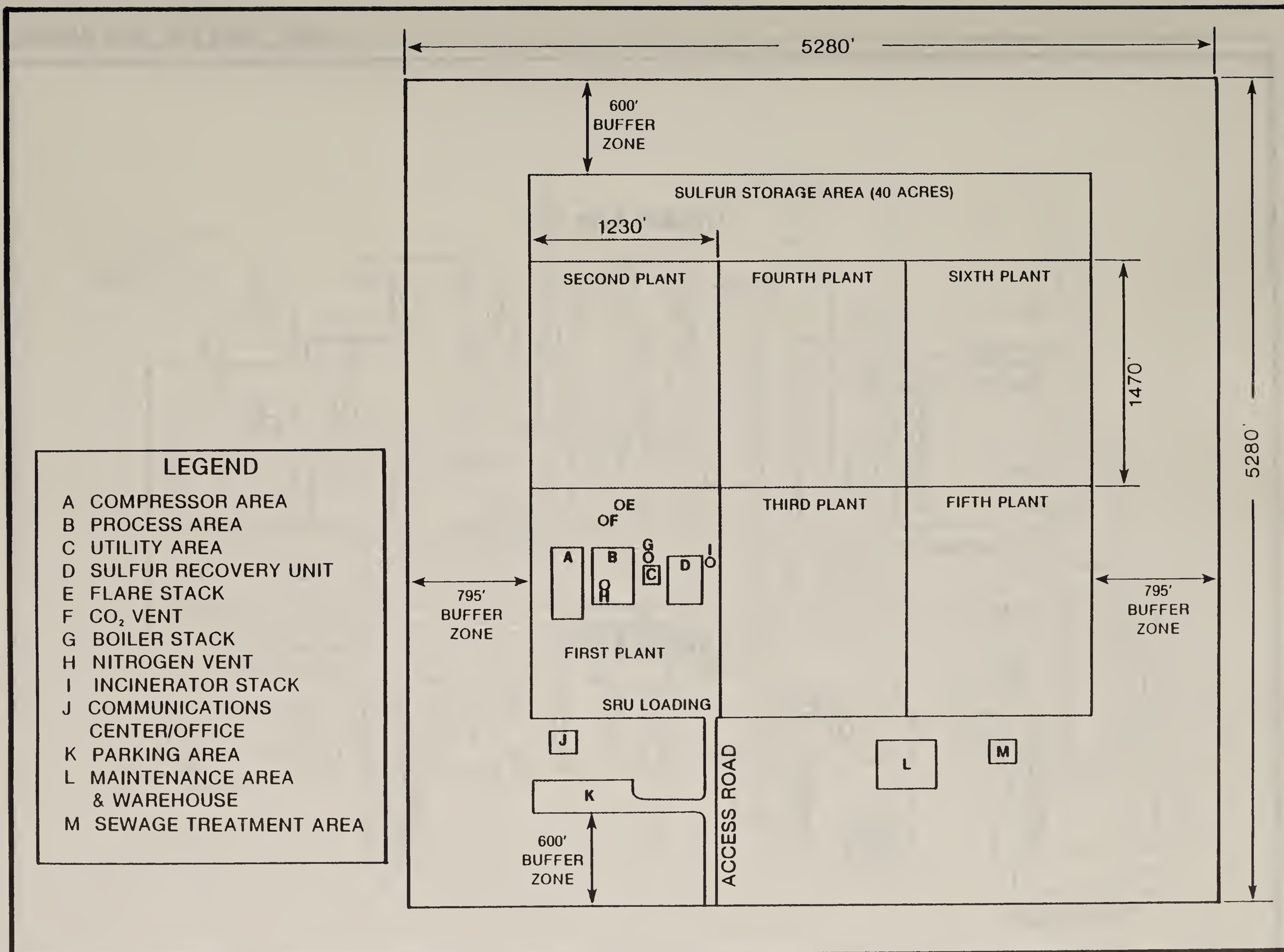


FIGURE 1-12 CONCEPTUAL SITE PLAN FOR A 1.2 BILLION CFD GAS TREATMENT PLANT

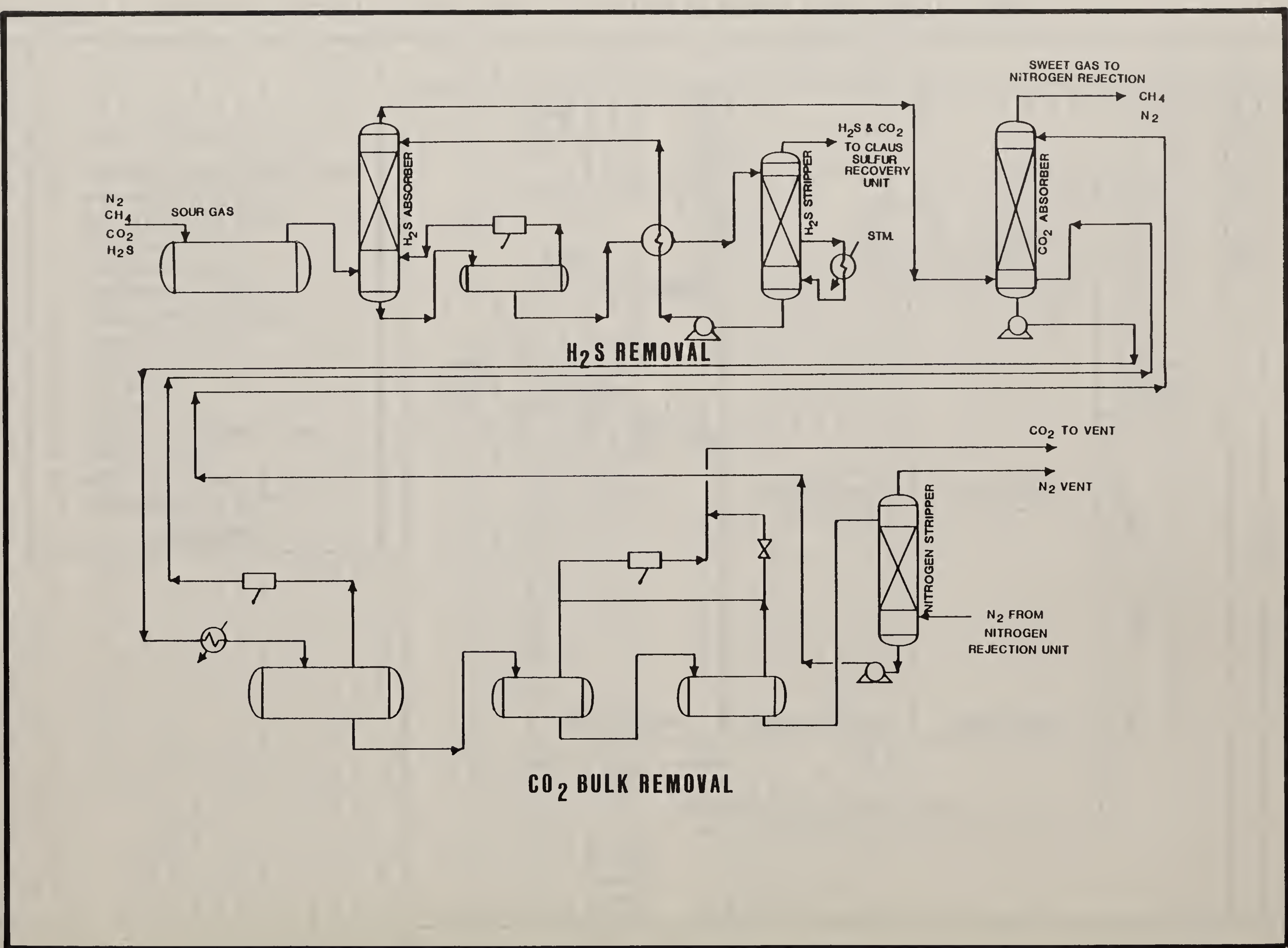


FIGURE 1-13. SELEXOL UNIT

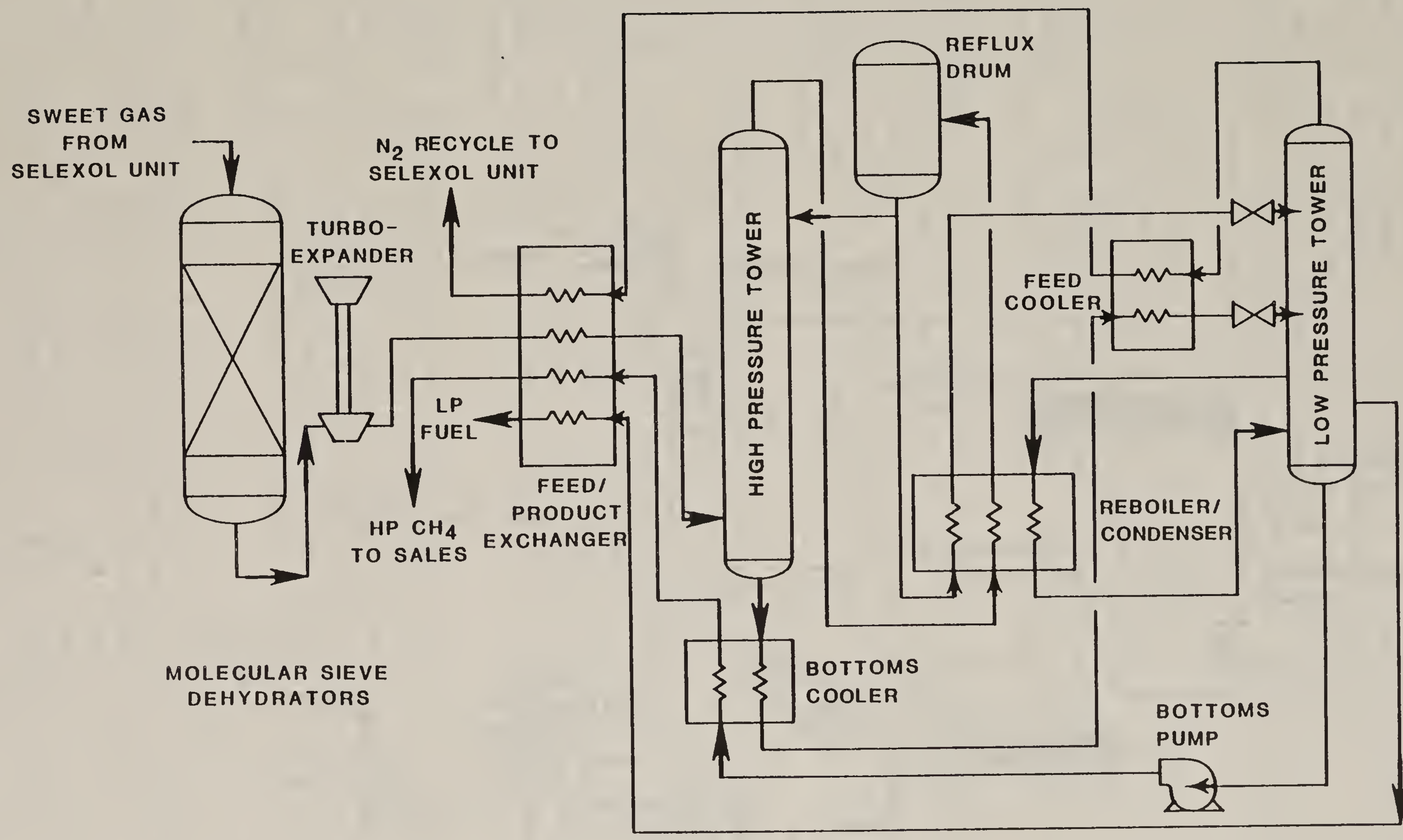


FIGURE 1-14. NITROGEN REJECTION UNIT

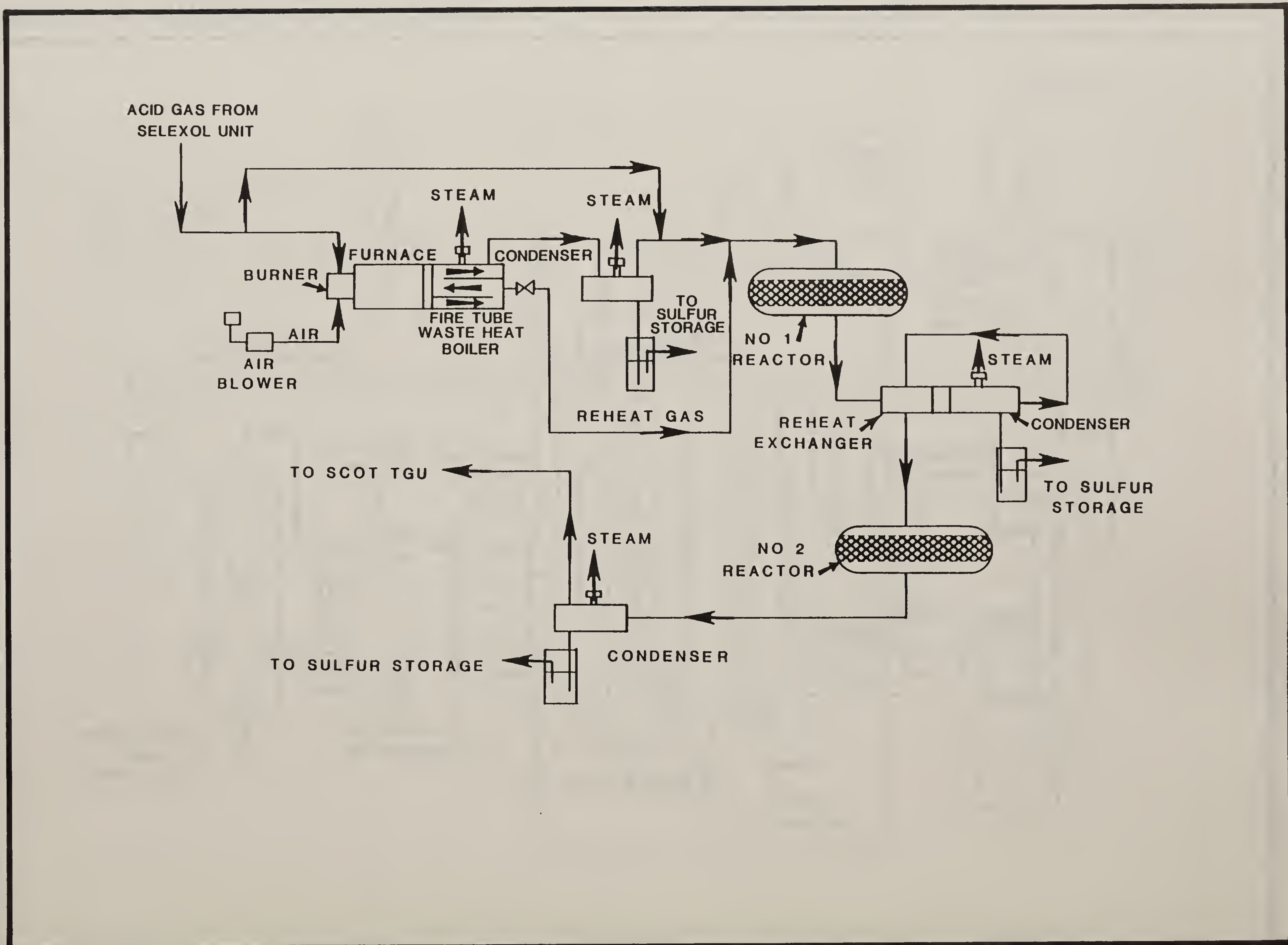


FIGURE 1-15. CLAUS SULFUR RECOVERY UNIT

diverted and reacted with air to form SO_2. This gas is cooled, mixed with the remaining acid gas flow stream, and then reheated before entering the first catalytic converter. In the catalytic converter, the H_2S and SO_2 react to form elemental sulfur. The hot gases leaving the first reactor are cooled to condense sulfur, then reheated and passed into a second reactor. Additional sulfur product is obtained in the second condenser. The steam generated in the condensers and the wasteheat exchanger is utilized in the Selexol Unit as a heating medium and for turbine drivers. The normal water makeup requirement for steam generation in a 200-million cfd module is 32 acre-feet/year (20 gallons/minute). Total sulfur production from a 200-million cfd sweetening module would be approximately 327 tons per day.

The sulfur storage facility would be capable of holding 1,960 tons of sulfur, the equivalent amount of sulfur produced by all six modules each day. The sulfur would be maintained in molten form and potentially transported in the above-ground molten sulfur pipeline to the terminus near Opal, Wyoming. This pipeline would be a proposed common pipeline with Exxon and is described under Exxon's facilities.

Tail Gas Cleanup. The tail gas from a Claus or similiar unit would be treated to minimize sulfur emissions to the atmosphere. A Shell SCOT unit is currently proposed to treat the tail gas for the following reasons: (1) total sulfur recovery can be 99.8 percent, (2) low sensitivity to Claus plant upsets, and (3) cost competitive with other high recovery (99.8 percent) processes.

A process diagram of a typical SCOT unit is shown in Figure 1-16. Claus tail gas is combined with hydrogen (H_2) reducing gas (generated in a stoichiometric burner) and passed over a cobalt-molybdenum catalyst to convert SO_2 to H_2S. The gas is then cooled and enters a contactor where methyl diethylamine (MDEA) or equivalent material absorbs essentially all of the H_2S and a portion of the CO_2. The MDEA stream is recycled back to the Claus unit for sulfur recovery. The overhead gas from the absorber is incinerated to convert the approximately 200 parts/million of H_2S and other sulfur compounds to SO_2.

Waste water generated from the tail gas units in a 200-million cfd sweetening module would be about 57 acre-feet/year (135 gallons/minute). This water results from the condensation of the water vapor generated in the sulfur conversion reaction and would be transferred to the water disposal system. The total fuel gas requirement for the stoichiometric burners and incinerators is approximately 3 million cfd for a 200-million cfd gas sweetening module.

Natural gas and CO_2 (if a market can be developed) produced at the plant would be transported in parallel pipelines to the proposed Trailblazer Pipeline terminus, approximately 5 miles southwest of Rock Springs, Wyoming (see Map 1-3, in DEIS). CO_2 would leave the plant at a pressure of approximately 2,000 pounds/square inch, pass through a metering unit, then into the pipeline for transmission to the proposed market. The initial flowrate would be 250 million cfd; maximum design capacity would be 700 million cfd. The sales gas pipeline would transport approximately 240 million cfd at a pressure between 850 and 1,000 pounds/square inch.

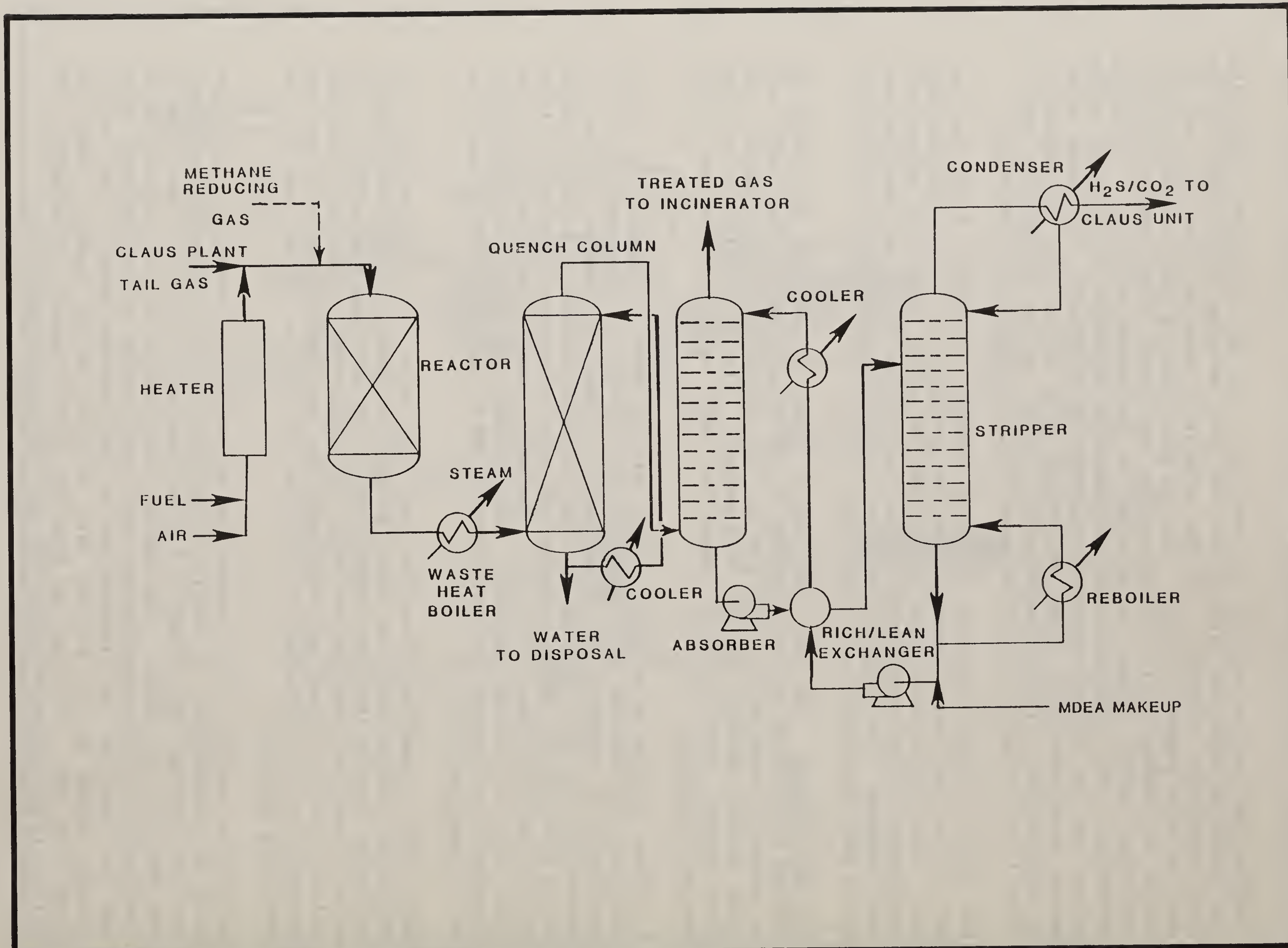


FIGURE 1-16. SHELL SCOT TAIL GAS UNIT

Power Supply

Power would be supplied by Utah Power & Light Company via a 345-kilovolt electric transmission line originating near the Naughton Power Plant (see Map 1-3, in DEIS). Tangent structures would be lattice steel H-frames (Figure 1-17). Spans would be approximately 1,000 feet in open terrain.

The phases of development for such a line would be right-of-way acquisition, surveying, access development and clearing of structure sites, excavation, grillage and form work, concrete work, stringing and tensioning, and cleanup and reclamation.

After the right-of-way has been acquired, a detailed centerline profile would be determined by a three to four-man survey crew using a four-wheel drive vehicle. If trees interfere with the survey, some centerline trimming or clearing may be needed to obtain line of sight; however, clearing is not normally required in sagebrush country.

When the survey has yielded the structure locations, access would be developed. Erection of tall structures would require that excavating equipment, concrete trucks, supply trucks, and a crane be able to reach each structure site. In rough terrain it could be necessary to construct some spurs from existing roads to the structure sites. Very little spur construction would be necessary in smooth terrain. Enough brush would be cleared at the structure sites to provide a clean tower assembly and erection area. The assembly area should be reasonably flat, free of brush, and about 100 feet by 50 feet in size. The tower site would be cleared to about 50 feet by 20 feet and could be contiguous with the assembly area.

Footings for the structures would require the excavation of pits at the location of each structure leg. If the local substrate is rock, drilling and blasting would be required. Spoil dirt would be piled nearby for backfilling.

Grillage, the assembly of reinforcing steel and attachment hardware used to strengthen the concrete footings and provide a way to fasten the structures to the footing, would be set preassembled into the excavations, and any necessary forming for the concrete would be done. Each concrete footing would be poured, finished, and allowed to cure for at least 28 days. Concrete would be premixed and hauled to the site. Excavations would be backfilled, tamped, and the surfaces shaped.

Steel would be delivered to the assembly sites on flatbed trucks and the structure preassembled in subsections on the ground. A crane would be brought to the site to place the sections on the footings and erect the structures.

When towers are in place, stringing crews would place stringing blocks on the structures. Pull-lines, and then conductor, would be drawn through the pulleys in 2- to 3-mile pulls. When sufficient conductor is in place, tensioning trucks would pull the conductor to the designed amount of sag, and the conductors would be attached to the permanent suspension hardware, and the stringing blocks removed.

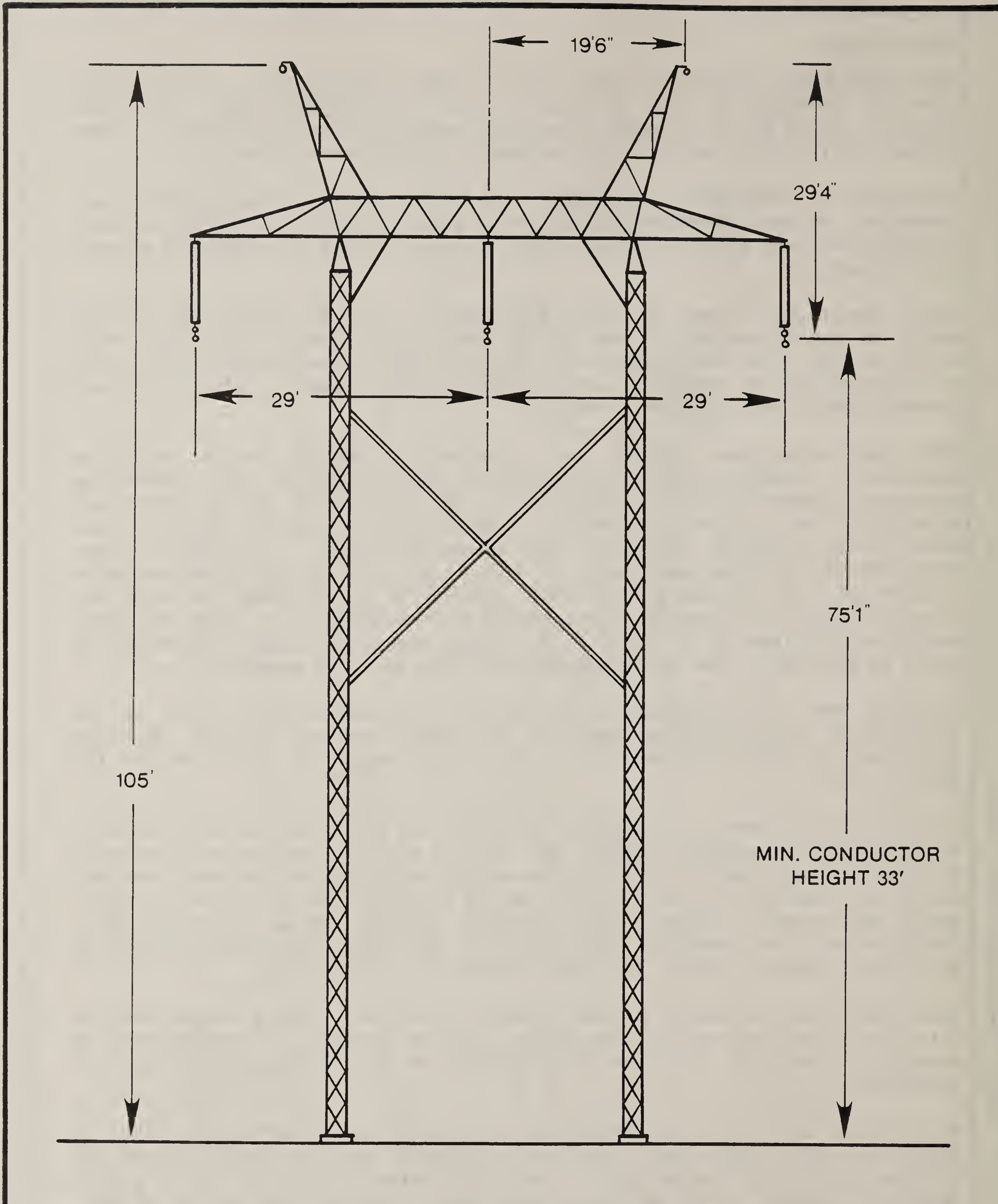


FIGURE 1-17 TYPICAL H-FRAME TANGENT STRUCTURE

During construction, trash would be stored in covered containers. When the line is complete, work areas would be cleaned and all trash collected. Dirt piles would be smoothed out; areas which have been cleared may be scratched and reseeded, if needed; and any access roads would be water barred and reclaimed.

Waste Disposal

A packaged-type treatment system would be used at the plant site to handle sewage. Treated wastewater would be used for construction or disposed of by deep well injection. Sludge would be trucked to a sewage plant for disposal. Waste water from the plant operation would be disposed of through a deep injection well on the plant site. These wells would require state and federal permits.

Miscellaneous solid waste would be disposed of in an off-site, approved sanitary landfill which has not been identified. Scrap metal produced by project construction would be sold to a recycling firm. Used oils, lubricants, and solvents generated during both the construction and operations phase of the project would be collected in tanks on the plant site until sufficient quantities are accumulated to sell these wastes to a re-refining firm.

Operation of the processing modules would produce spent catalyst. This catalyst must be changed about every three years, depending on operating conditions. New catalyst would be brought in by a supplier and the spent catalyst would be removed by the supplier as part of the re-charge process. Spent catalyst would be returned to the manufacturer for regeneration.

Water Supply

Potable water needs per day during construction vary from 12,000 gallons for a 150-man work force to 26,000 gallons for a 325-man work force (Table 1-5). This water would be taken from an on-site groundwater well. Treated sewage effluent water (resulting from use of potable water) would be used for construction needs, such as road watering.

Ancillary Plant Facilities

These facilities would include structures such as office and communication buildings, and the maintenance base. The maintenance base would be located at the plant site and would be used by well field personnel during drilling, well completion, and production operations.

Access Roads

Sublette County Road 23-134 (Calpet Road), a hard-surfaced two-lane road, originates and terminates with U.S. Highway 189 by making a loop from south of Big Piney to LaBarge. An access road would be required from Calpet Road to the treatment plant. This road would be about 2.3 miles long; the roadway would be 24 feet wide and paved for access to the plant. The road would be constructed on a 30-foot right-of-way.

Construction and Operation Schedule

Site construction activities would be related to foundations and buildings. The modules to be installed at the plant would be fabricated off-site and

shipped to the plant site. Temporary construction staging areas would be required to assemble the modules for subsequent installation. Initial construction activities on foundations and buildings would begin in 1984, requiring approximately 150 people. Modules would be installed during spring 1985 and would require a peak work force of 650 people (325/module). It is anticipated that two modules would be ready for operation by January 1, 1986, another by January 1, 1987, two more by January 1, 1988, and the sixth module by January 1, 1989.

The treatment plant would operate 24 hours per day and employ a total of 150 people. The day shift would consist of 110 people, including office staff, maintenance workers, operators, and administrative personnel for all six modules. This level of work force and schedule is anticipated to continue for a minimum of 20 to 30 years, the estimated life of the wells. The evening and night shifts would consist of approximately 40 operators and maintenance personnel for all six modules. Operations and maintenance personnel would live in surrounding communities and commute to work.

Abandonment

At the end of the facility's useful life (estimated life span, 20 to 30 years), Quasar would obtain authorization from jurisdictional agencies to abandon the facilities. Each company would be required to file a detailed abandonment plan which would describe the planned revegetation and reclamation procedures. Quasar would purge all plant facilities of sour gas or other contaminants. All above-ground facilities, foundations, and salvageable material would be removed. Unsalvageable materials would be disposed of at authorized disposal sites. The plant site would be regraded and revegetated according to the Erosion Control, Revegetation, and Restoration Guidelines (see Appendix B of the Draft EIS). The federal, state, or other land-managing or jurisdictional agencies may place reasonable conditions upon abandonment as needed. In addition, abandoned rights-of-way would revert to the private landowner's or agency's control.

WILLIAMS

Williams' application for the Riley Ridge Project covers only well drilling and sour gas production and transportation. Williams would transport its gas to Quasar's East Dry Basin treatment plant where it would be purchased by Quasar. From that point on, the gas would become part of Quasar's proposed project, which has been described in an earlier section.

<u>Well Sites</u>

Williams plans to drill 24 wells in the Sawmill Area (see Map 1-3, in DEIS), each requiring 3.7 acres. The main drilling program would begin in 1984 and continue through 1990. Two rigs would be in operation, and normal drilling operations would require approximately 180 days per well. A life span of 20 to 30 years is projected for these wells.

Construction, Drilling, and Well Completion

Components of the well field would be constructed utilizing the same techniques as described for Quasar with the exception that power would be

generated at the well sites. A maintenance base camp and office would be constructed for use by company field personnel during the drilling, completion, and production operations. It is anticipated that the office would be located on or near the well location in the SW1/4 of Section 2, T29N, R114W, Sublette County, Wyoming. The unit would require a 0.5-mile electrical transmission line from an existing mainline. Single-phase power would be run into the office and would require no more than ten power poles. Total power requirements would not exceed 15 kilowatts. A 50 gallons/minute water supply well would provide water for drilling and field office use. A septic system would be constructed at the office site.

Truck traffic to and from the well sites during drilling operations would total approximately 12 to 20 trucks per day. During completion operations, 6 to 10 trips per day are anticipated. During operation and maintenance, truck traffic would be 1 or 2 trips per day.

A total of 20 to 25 people would be required for the drilling operations, with a maximum of 56 in the field at any one time. When production begins from the completed wells in 1985, a small crew would be required to monitor the production facilities and gathering lines. By 1991, the crew would consist of four field pumpers.

Wellhead Operation and Abandonment

Procedures for operation and abandonment of the well sites would be similar to the procedures described for Quasar.

The single water well capable of producing 50 gallons/minute would be necessary during drilling operations. Additional wells may be necessary as well field development continues. During wellhead operation, water produced from the dehydration units would be stored in fiberglass storage tanks on site, and trucks would haul the water to a disposal site.

Waste Disposal

Disposal of waste from the well sites would follow the general procedures previously described for Quasar. Estimated wastes to be generated by the Williams facilities are included in Table 1-10.

Safety

Williams would follow the safety procedures previously described for Quasar.

Required Resources

The water, gravel, and rip rap requirements for well field development are provided in Tables 1-5 and 1-8.

Access Roads

Access roads would be constructed to each well site using existing roads wherever possible. New roads would be designed to minimize additional disturbance. Present plans by Williams call for 29 miles of access roads (new and improved), with a 35-foot right-of-way width. Road clearing would require removal of all vegetation (grasses, shrubs, brush, and trees) for roadbed construction. The disturbance area should not exceed 30 to 35 feet for permanent roads.

Gathering System

The gas gathering pipeline system would consist of pipelines varying in diameter from 6 to 20 inches. The sour gas trunk line would transport the gas to Quasar's East Dry Basin treatment plant. Planned production with 24 wells in operation would be 360 million cfd.

Construction of the gas gathering pipeline system would be accomplished in from 4.5 to 6 months and would begin in 1985. Workers would probably be housed in nearby communities.

EXXON

Well Sites

Exxon plans to drill 75 wells in the Lake Ridge, Fogarty Creek, Graphite, Dry Piney, and Dry Piney Annex Units (see Map 1-3, in DEIS); each well would produce an estimated 20 million cfd for the first 12 to 15 years. An average of six wells would be drilled each year. This would require approximately six drilling rigs operating simultaneously. An average of 30 days would be required for the drill pad construction. The number of drilling days required to reach total depth would depend on the actual measured depth of the well. It is expected to require 230 days to drill a well; the well completion and stimulation operations would require about 25 days.

Twenty workers for each drilling rig would be on the site during normal drilling operations. The crews would be housed in trailers on the site if they do not live locally. Assuming that six rigs would be operating in the field at any one time, 120 workers would be required for the drilling operations.

Construction, Drilling, and Well Completion

Exxon would utilize the standard construction, drilling, and well completion techniques previously described for Quasar. Each drill site would be approximately 540 feet by 540 feet (6.7 acres). Each drill site would have a reserve pit with a capacity of approximately 7.2 acre-feet. The wells would initially be spaced at one well per 640 acres.

Wellhead Operation and Abandonment

A typical Exxon production well site would consist of approximately 1.9 acres of cleared area around the wellhead for production facilities. An access road would lead to each wellhead for maintenance and repair of the production facilities. The gas would be piped underground to the nearest dehydrator site for water removal. Exxon would utilize triethylene glycol (TEG) dehydration systems to remove water from the gas and minimize corrosion in the gathering system pipelines. The produced gas would be dehydrated to a 10°F dewpoint (approximately 7 pounds of water/million standard cubic feet of gas). The dehydration systems would be sized to process at least 20 million cfd. Where feasible, larger dehydration units would be provided to serve several wells, thus reducing the surface facilities and associated land requirements at each well site.

The major equipment required to dehydrate the produced gas consists of an inlet cooler, gas-TEG contactor, and a TEG scrubber. Other equipment would be installed to remove water from the "rich" TEG, recycle "lean" TEG to the gas-TEG contactor, and prepare the produced water for disposal. This equipment would include a high-pressure flash tank, a TEG regenerator, vapor cooler, vapor recompressor, sour water stripper, and storage tanks for glycol and stripped water (15 feet in diameter and 15 feet high). Electrically driven compressors would be installed upstream of the dehydration units to maintain adequate supply pressure at the treatment plants as the reservoir pressure declines. Water produced during wellhead dehydration would contain approximately 366 parts/million of H_2S.

The water produced during dehydration would be collected in well site storage tanks. It is currently planned to pump the water through buried pipelines to central disposal wells. Approximately 1.6 acre-feet per year would be produced per well from the wellhead dehydration systems (Table 1-5).

The dehydration equipment would be constructed on skid-mounted modules at a remote location and shipped to the well sites for erection. Total utility and raw material requirements for the well field development for 75 wells are shown in Tables 1-6 and 1-8. Overhead electric power lines on single wood poles are planned. The lines would follow the gas gathering system right-of-way where possible and would originate from the substations at the treatment plants.

The gas pressure at the wellhead would initially be about 3,000 pounds/square inch. The pressure would be reduced by a properly sized choke valve, to about 1,440 pounds/square inch, the operating pressure of the dehydrator. Valves would be installed at each well and dehydrator site, and at appropriate intervals along the gathering pipelines to facilitate the operation and maintenance of the system, as well as reduce the potential hazards in the event of line rupture. Gas production would be metered at the well site downstream of the dehydrators. Cold weather operation could cause CO_2 to condense in the gathering system, therefore, ball or pig launchers and receivers, if required, would be provided at sites on the system most accessible by access roads.

Exxon would utilize the same procedures for well site abandonment as were previously described for Quasar.

Waste Disposal

Exxon would utilize waste disposal procedures similar to those previously described for Quasar. Estimated solid waste, sanitary waste, and waste water to be generated by Exxon are provided in Table 1-10.

Safety

Safety procedures to be followed by Exxon are similar to the procedures previously described for Quasar.

Required Resources

Water required for drilling would be supplied by water wells drilled near the well sites (Table 1-5). A typical water well is expected to produce

50 gallons/ minute. In the event that not enough water is produced, it would be trucked in. There are existing quarries for gravel and riprap nearby (Table 1-8); however, Exxon would require additional quarries near the construction sites which would require additional environmental analyses.

Access Roads

Approximately 101 miles of access roads to the well sites are currently planned. Of this, 25 miles would be existing light-duty roads requiring only maintenance; 36 miles would be existing unimproved roads requiring upgrading and maintenance; and 30 miles would be new roads. Existing roads would be used wherever practicable. A construction right-of-way width of 50 feet would be required to construct new roads and to upgrade existing unimproved roads. The major activities for road construction would be clearing, topsoil stripping, excavation, construction of drainage ditches and drainage structures, surfacing, cleanup, and restoration of cut and fill slopes.

The right-of-way would be excavated and compacted until a suitable, stable, roadway of the proper width is constructed. The fill would be compacted with suitable equipment. Moisture would be added, if required, to obtain adequate compaction. Where adequate surfacing material is not present, gravel would be applied to the roadway to prevent the road subbase from failing under the superimposed loads.

Gathering System

When all 75 wells are producing, there would be approximately 91 miles of sour gas gathering pipelines with assumed right-of-way widths of 100 feet. The total disturbance is estimated at 1,103 acres. The techniques for construction, operation, and abandonment of the gathering system would be similar to those described for Quasar.

Treatment Facilities

Treatment Plant Modules

Exxon currently plans to construct two 600-million cfd plants, one each at West Dry Basin and Big Mesa. The total area required for each plant would be approximately 160 acres with a 480-acre buffer zone, for a total of 1,280 acres.

An overall process diagram for each 600-million cfd treatment plant, consisting of three identical 200-million cfd modules, is presented in Figure 1-18. The gas treatment process would be the same as that described previously for Quasar, except that the Claus sulfur recovery unit would have three catalyst beds.

The estimated products and releases from each treatment plant include 126 million cfd of natural gas for sale, 9 million cfd of fuel gas for plant use, 1,120 tons/day of sulfur for sale, 330 million cfd of CO_2, 56 million cfd of nitrogen/inerts to be vented, and approximately 4 tons/day of sulfur compounds and 57 million cfd of CO_2 released to the atmosphere from the tail gas stack (see Tables 1-1 and 1-9).

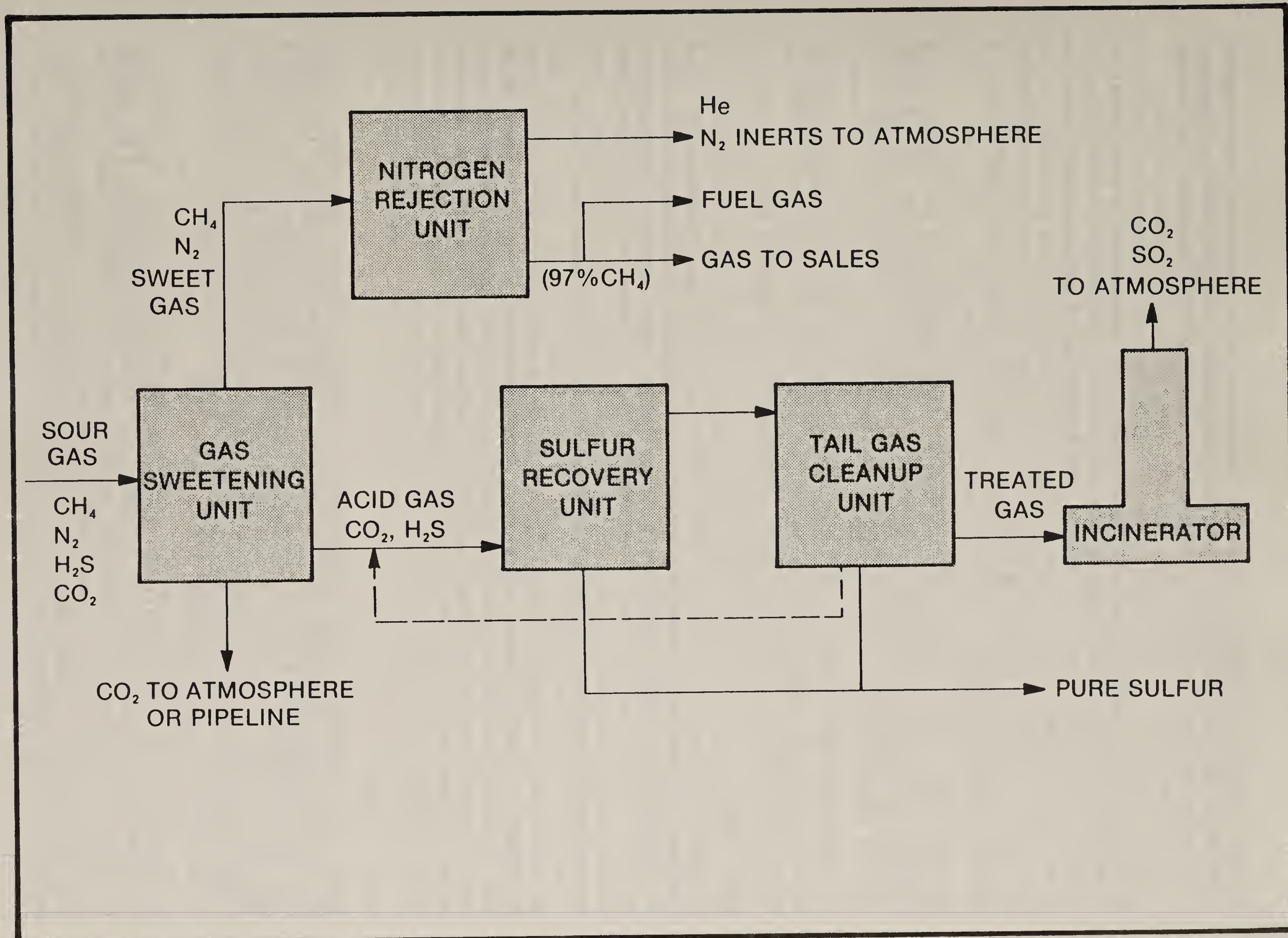


FIGURE 1-18. REPRESENTATIVE DIAGRAM FOR RILEY RIDGE TREATMENT PLANTS

Primary support facilities for each treatment plant and the sulfur loadout facilities would consist of steam boilers, electrical distribution systems, fire water systems, potable and raw water systems, drain systems, wastewater and solid waste disposal, sewage systems, vent stacks, and storage tanks.

At each plant, start-up boilers would serve all three modules by generating steam for a two- to three-day period when one of the modules is being put on stream. Once the plant is running, the boiler would be shut down since the plant would become steam self-sufficient by utilizing steam generated in the Claus SRU and the SCOT tail gas units. At the sulfur loadout facility, a boiler (1.0 million Btu/hour) would be required to generate steam for tank and pipe stream tracing.

A fire water system would be provided for fire fighting at each plant. The systems would be designed to provide 2,250 gallons/minute for 9 hours through strategically located hydrants. A smaller fire water system would also be provided at the sulfur loadout facility.

Storage tanks of various sizes would be provided at each treatment plant for Selexol solvent, methyl diethylamine for the SCOT tail gas unit, make-up water, wastewater, lube oil, sulfur, diesel fuel, and propane gas.

Power Supply

Exxon also plans to purchase electrical power from the Utah Power & Light Company. Electrical power for operation of Exxon's treatment plants would be supplied by the 345-kilovolt transmission line originating near the Naughton Power Plant, as described for Quasar. A lower voltage distribution system would be constructed to supply each plant area. The gas field electrical distribution system would also originate from these substations.

In the event of power outage, diesel-driven emergency generators would be provided at the following locations: each treatment plant to supply power for critical process controls, detection and alarm systems, lighting, and other required systems, and the sulfur loadout facility and the starting point of the sulfur pipeline to provide heating to ensure that the sulfur stays molten.

Waste Disposal

Table 1-10 summarizes the solid wastes, sanitary wastes, and waste water which would be generated by the project. Wastewater from the treatment plants and dehydration units would be disposed of by injection into suitable geologic formations. Waste water generated at each treatment plant is contaminated with H_2S (approximately 600 parts/ million). Exxon is investigating treating the waste water to remove dissolved H_2S and then disposing of the water in lined evaporation ponds.

A drain system would collect miscellaneous process drains and boiler blowdown, and route them to a holding tank from which they would be pumped to an injection well. A separate drain system for hydrocarbons would be provided to collect small quantities of compressor oils, scrubber blowdowns, and tank drains. These materials would be disposed of in accordance with appropriate regulations.

Solid wastes generated during operation of the facilities would be collected in a centralized location, compacted, and transferred by truck to a sanitary landfill or other solid waste disposal site.

A sewage system would be installed at each plant and the sulfur loadout facility to collect sewage from the control rooms, maintenance shops, and administration buildings. This waste would be treated through either a packaged treatment unit or a septic tank.

Water Supply

A potable water system for personnel use and a raw water system for boiler makeup and other uses would be required at each treatment plant and the sulfur loadout facility. Potable water supply systems with capacities of approximately 4.8 acre-feet/year (3 gallons/minute) at the sulfur loadout facility and 12 acre-feet/year (7.5 gallons/minute) at each treatment plant are currently planned. These systems would consist of water wells with submersible pumps, gathering system, treatment facilities, surge tanks, booster pumps, and distribution systems. Electrical power would be supplied as required.

Raw water supply systems with capacities of approximately 6.5 acre-feet/year (4.5 gallons/minute) at the sulfur loadout facility and 126 acre-feet/year (78 gallons/minute) at each treatment plant are currently planned (see Table 1-5). The systems constructed for the potable water supply may be combined with the raw water supply system, except that separate treatment facilities, surge tanks, booster pumps, and distribution systems would be required to keep the potable and raw water supplies separate.

At the sulfur loadout facility and each treatment plant approximately one and three water wells, respectively, would be drilled into the Wasatch formation. It is expected that each well would have a maximum yield of 50 gallons/minute (80 acre-feet/year) and would be drilled to a depth of less than 500 feet. Access roads to the water well sites would be constructed for maintenance of the wells. Electrical power lines to the well sites would follow the access roads and would supply power to the submersible pumps. The water well sites, access roads, power lines, surge tanks, and treatment facilities would be located on the right-of-way for the sites.

The submersible pumps installed in the water wells would provide the hydraulic lift required to move the water through the gathering systems and into the surge tanks. The gathering systems would be buried below grade for protection from cold weather. Treatment facilities would provide settling, filtering, and chlorinating treatment systems as required. Chemical analyses of potable water would be accomplished to ensure compliance with all applicable standards. Surge tanks with adequate capacities would be provided to supply peak demands. Pumps located at the surge tanks would supply the required distribution system pressures. Distribution piping would supply the water users.

Ancillary Plant Facilities

A key telephone system would be used to provide access to lines serving the plants from any telephone set. It is assumed that either Wyoming Telephone

Company or Mountain Bell Telephone Company would provide and install the telephone lines. The closest trunk facility to the plants is at Calpet, Wyoming, and would require approximately 11 miles and 5 miles of buried cable to the West Dry Basin plant and Big Mesa plant, respectively. A number of outside explosion-proof telephone sets are planned to be installed at various operations and process centers on the immediate site grounds. This would provide field personnel with the same telephone and intercom functions as the in-plant service.

Separate two-way radio systems would be used by divisions in plant operations, field operations, and drilling. In addition to supplying separate communications channels for each division of labor, all radio systems would be tied together at a central radio console.

Access Roads

Access roads would be required to both Exxon treatment plants. A turnout would be constructed at Calpet Road, and an access road would be constructed to the West Dry Basin plant site. This road would be approximately 0.5 mile long and would be paved with asphaltic concrete to the plant site entrance. The roadway width would be 24 feet and would be constructed on a 50-foot right-of-way. The road would be designed to be passable all year. Drainage structures at the plant site entrance and at Calpet Road would be provided if required.

Existing gravel surfaced roads would be upgraded and maintained to provide access to the Big Mesa plant site. Approximately 2 miles of Sublette County road would be improved in accordance with plans approved by the county. An additional 3 miles of road would also be improved.

An access road would also be constructed to the sulfur loadout facility located approximately 2.5 miles east of Opal. U.S. Highway 30 passes near the site. A turnout would be constructed at U.S Highway 30, and a road to the facilities would be constructed as described above for the West Dry Basin treatment plant.

Plant Construction and Operation Schedule

All three 200-million cfd modules for the first 600-million cfd treatment plant may not be constructed at the same time. Construction of the first module would start after the necessary permits are granted, which is anticipated to be in early 1984. Start-up of the first module would then occur in early 1986, the second module in early 1987, and the third module in late 1988. The last two modules would utilize some of the off-site facilities installed for the first module. Each plant site would be cleared and graded prior to construction. A pit would be opened at an approved site to supply the gravel for surfacing material.

Construction of the first module of the second plant would begin in late 1988, and start-up would occur in early 1990. The second module would be started up in early 1991, and the third module in early 1992.

Major parts of each module would be skid mounted to minimize field construction time and labor. The skids would be fabricated in a

contractor's shop, transported by truck to the plant site or by rail to Opal, and then trucked from the Opal rail terminal to the site. They would then be mounted on a concrete pad and the required piping tie-ins made.

A work force of approximately 281 would arrive on site in the spring of 1984 to initiate foundation and building construction. During the winter of 1984 and 1985, the first module would be fabricated in a shop. The estimated peak work force for construction the first module would be 325 in the spring of 1985. This figure should increase to about 535 as construction begins on the second module in mid-1985, and then decrease back to 369 as the first two modules are completed and construction of the third module begins in 1987. The number of workers should increase back to 450 as construction starts on the first module of the second treatment plant with the peak remaining at this level through 1990 when the second module of the second plant is being built. The peak work force should drop to 344 in early 1991 as construction of the third module of the second plant continues. Because of continued construction over the long duration of this project, it is assumed that the construction workers could be absorbed into nearby communities.

Each 600-million cfd treatment plant would be designed to operate on a 24-hours per day, 7-days per week, production schedule. The operations and maintenance personnel requirements are estimated at 192 people, consisting of a daytime staff of 150 people and an evening and night shift of up to 42 people.

Abandonment

Exxon would follow the same procedures for treatment plant abandonment as those described for Quasar.

<u>Sulfur Pipeline and Loadout Facility</u>

Elemental sulfur is a by-product of H_2S processing in the treatment plants. Approximately 2,240 tons of sulfur per day would be produced when the two plants are operating at design capacity. (Quasar's sulfur production would be an additional 1,960 tons/day.) Exxon plans to transport the sulfur as a molten liquid in a 55-mile long, electrically heated 6-inch diameter, above-ground pipeline from the treatment plants to a loadout facility (Figure 1-19) that would be located on a railroad spur near Opal, Wyoming. This pipeline (Figure 1-20) would be a proposed common pipeline with Quasar. To date an electrically heated molten sulfur pipeline of this length has not been built and operated. In addition, sulfur production from the initial 200-million cfd gas treatment module at the West Dry Basin plant may be transported by trucks prior to startup of the proposed molten sulfur pipeline.

The system would be powered by a 69-kilovolt transmission line paralleling the liquid sulfur line; the line would receive power from Utah Power & Light at the plant site, pipeline midpoint, and loadout facility. Emergency generators to power the heating system would be located at both ends of the pipeline to ensure a source of power should an outage of commercial power occur.

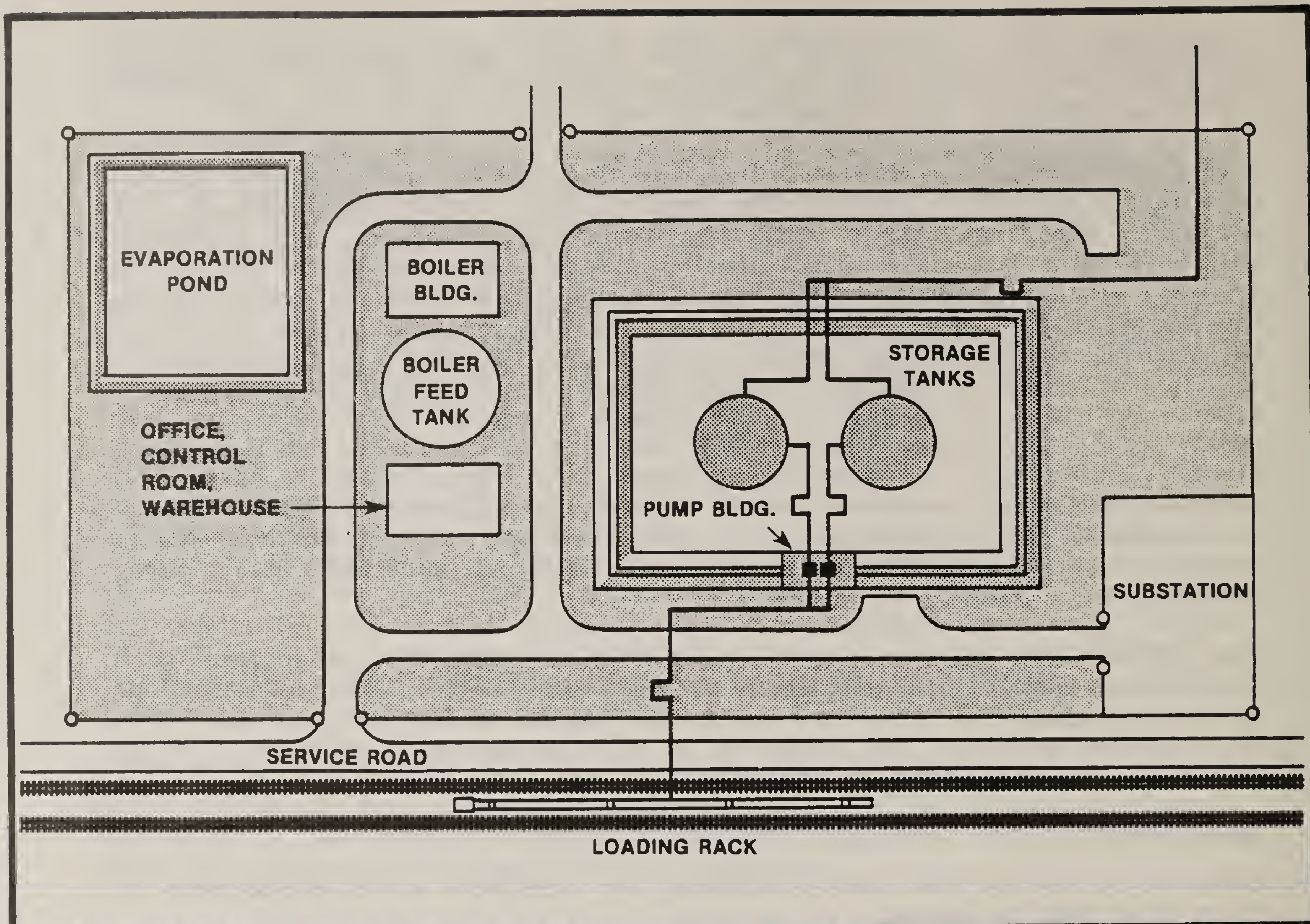


FIGURE 1-19 SULFUR LOADOUT FACILITY

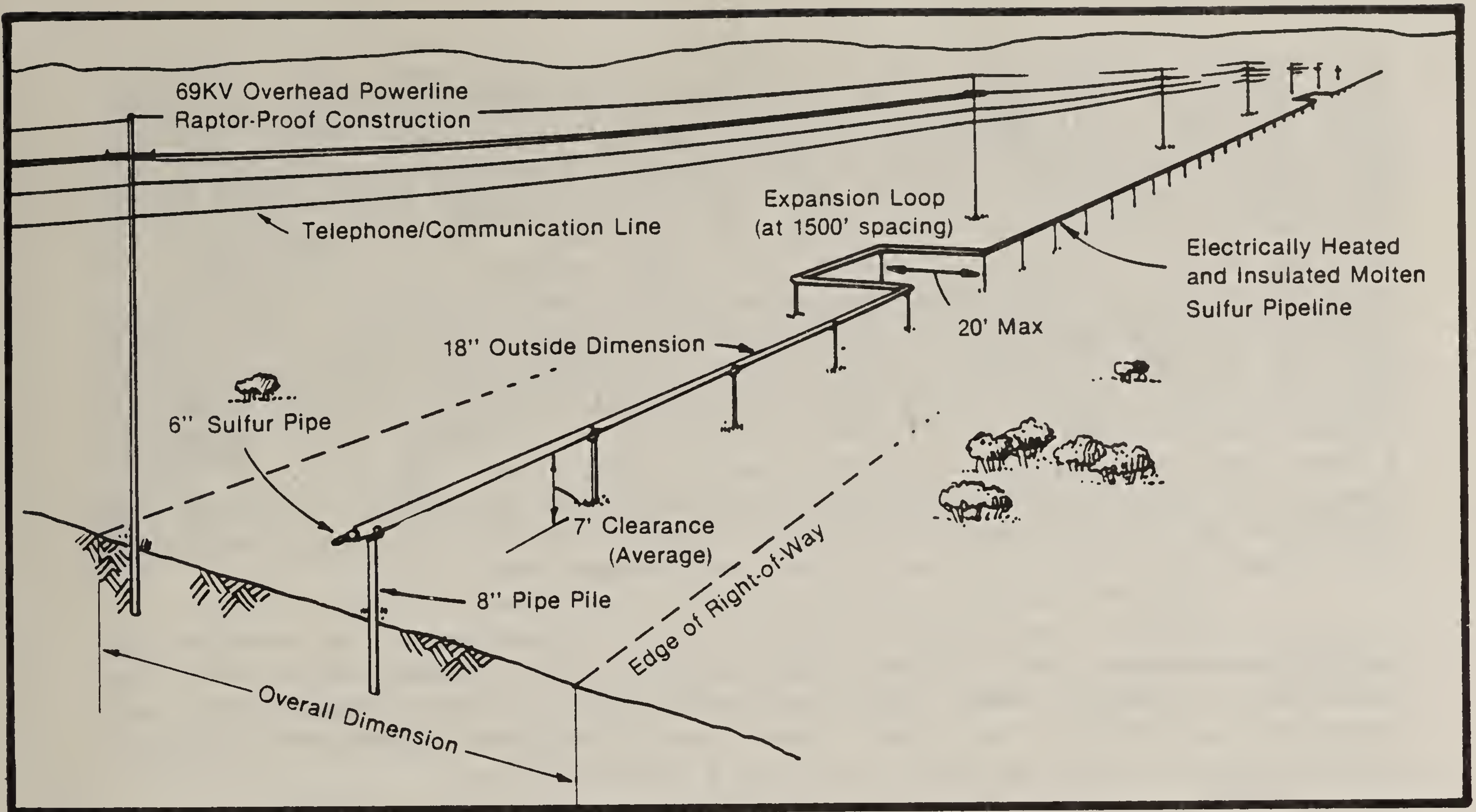


FIGURE 1-20 SULFUR PIPELINE

The pipeline would maintain the temperature of the molten sulfur at between 265°F and 285°F. At temperatures below approximately 235°F sulfur forms an odorless, brittle solid which is not soluble in water. When operation or maintenance requirements warrant it, the sulfur would be drained into earth containment pits located adjacent to the pipeline. This is expected to be required very infrequently. There are eight natural low points along the proposed pipeline route where the molten sulfur would collect. Pit location and design would be subject to BLM approval. Five of the natural low points are near stream crossings; however, the containment pits would be located outside of the riparian zone and constructed to avoid contamination of surface waters. Drainage pits would be sized for a nominal sulfur depth of 3 feet; the capacity of these pits would range from 1,300 to 19,000 cubic feet. The sulfur would solidify in the pits and be loaded on trucks and hauled to the loadout facility at Opal. The disturbed area around the earth containment pits would then be restored and revegetated.

A sophisticated instrumentation and control system would be provided to monitor and control the liquid sulfur pipeline. This system would enable an operator to observe the status of the pipeline (i.e., temperature and pressure) and control the flow. These control features enable the operator to shut down the pipeline should leaks or a rupture occur.

Pipeline Construction

Approximately 22 months during a three-year period and a peak work force of 470 would be needed to construct the sulfur pipeline and loadout facility. A maximum of approximately 40 persons would be needed for an operation and maintenance force for the pipeline and loadout facility to support the two treatment plants.

The molten sulfur pipeline would be located above ground on 8-inch diameter pipe piles. The major activities for construction of the pipeline, in order of occurrence, would be:

- Cleaning and grading of site
- Drilling, setting, and grouting of pipe pilings
- Stringing, welding, and radiographic examination of pipe
- Raising and setting pipe on pilings
- Installing heater cables
- Insulating and covering field joints of pipe
- Hydrostatic testing of pipeline
- Electrical testing of pipeline heating system
- Cleanup and restoration of site

Vegetation would be cleared from a 10-foot wide area under the pipeline and about a 50-foot wide area in forested and wooded areas for vehicle travel and work space. The 20-foot expansion loops located every 1,500 feet could be accommodated on the proposed 75-foot-wide construction right-of-way. Trees growing in or along the permanent 60-foot right-of-way would be removed if they could fall across the elevated pipeline. During the operation phase of the project, the same portions of the rights-of-way would be allowed to revegetate; however, trees growing where they could fall across the pipeline would be removed as necessary.

In remote areas where there are no access roads, the right-of-way would be the primary path of surface travel for pipeline construction. In order that vehicles might safety traverse the right-of-way, bridges or culverts would be constructed across creeks and arroyos on the working side of the right-of-way (where permitted by the federal surface management agency or the landowner).

At two major highway crossings along the proposed route, the pipeline would be placed in an underground tunnel. A minimum overhead clearance of 14 feet would be provided at secondary road crossings. Overhead clearance warning structures would be placed on secondary roads prior to the sulfur pipeline crossings.

If blasting is necessary, the following safety precautions would be adhered to in all instances:

- In areas of human use, shots would be blanketed (matted).
- Landowners or tenants in proximity to the shot would be notified in advance so that livestock and other property could be adequately protected.
- Before detonation, a clearance would be made to ensure that construction personnel and equipment and local residents are in no danger.
- Fire protection measures would be implemented.

Once the right-of-way has been prepared, setting of pipe pilings would begin. For the most part, the pipeline would be centered on a line 10 feet from one edge of the permanent right-of-way. Piling holes would be drilled 30 feet apart and 5 to 10 feet deep (depending upon above-ground clearance), an 8-inch pipe length set in the hole, and the pipe grouted in place.

After completing the welding and radiographic examination of the pipe, it would be lifted in relatively long segments and set on the pilings. After pulling the heater cables through the conduits, the pipe field joints would be insulated and covered. The pipeline would be hydrostatically and electrically tested after completing the above activities. The hydrostatic test would be at 125 percent of maximum operating pressure.

Where the pipeline is in proximity to creeks, a dike or berm would be constructed on the downhill side of excavations and disturbed areas to prevent excessive siltation of the creek. Excavated materials would be placed above the high-water mark on the creek banks.

Specific construction techniques would be selected for each creek crossing that would minimize the amount of erosion and siltation. Where the creek has a solid gravel base, permission would be requested for vehicle crossings. Where there is an access road in proximity, the existing access road would be used. Where the flow is too deep for vehicles to cross, or the creek has a muddy bottom, and there is no access road in proximity, flume pipes would be installed in the creek bottom and a roadway constructed on top for vehicle passage.

Where the pipeline would cross creeks, the supports would be located and would be of such a depth, that high water would not affect the pipeline through scour action. The pipeline would be at a height that high water would not have an affect. Clearance for floating debris would be provided. Construction of creek crossings would be made in a manner that minimizes the effects of construction on water flow. The gradient of the stream would be maintained by removing all spoil from the creek bed upon completion of construction and the creek banks would be restored.

No access road along the sulfur pipeline is proposed. After construction and initial startup, monthly inspection and maintenance would be accomplished through the use of four-wheel-drive vehicles or tracked snow machines, in conjunction with aerial reconnaissance. Maintenance or snow removal on the trail is not planned. The right-of-way will be rehabilitated following construction.

Loadout Facility

The sulfur loadout facility would include railcar loading facilities, sulfur storage and handling facilities, boiler facilities, water treatment facilities, and an operations/maintenance building. Product storage would be provided in the event of transport or market interruptions. Approximately 1 mile of railroad spur would be constructed, and 0.5 mile of existing unimproved road would be upgraded to provide access. Twenty-four 100-ton railroad cars would be loaded per day for full-scale plant operations. Two natural gas-fired boilers would be installed at the loadout facility, with each boiler capable of delivering approximately 750 pounds of steam/hour at 69 pounds/square inch and 315°F.

Four sets of tracks would be provided to fill railcars with sulfur, store full railcars, store empty railcars, and shuttle railcars between the various tracks. The sulfur loadout facility and pipeline would require approximately 30 operations and maintenance personnel for the 600-million cfd production rate and 40 personnel for the 1200-million cfd rate.

Abandonment

The sulfur pipeline and loadout facility would be abandoned and reclaimed in the same manner as all of Exxon's above-ground facilities. That is, equipment would be removed, the pipeline would be drained and dismantled, foundations would be demolished to below ground level, and the disturbed area would be revegetated.

NORTHWEST/MOBIL

Northwest and Mobil have submitted a joint application for the development of sour gas in the Riley Ridge Project area. Mobil has lease holdings in the gas field and would drill wells and produce the sour gas. Northwest would purchase the gas at the wellhead and transport it to the proposed Craven Creek treatment plant. After removal of the H_2S, CO_2, and inerts, the sales gas would be transported to Northwest's existing pipeline system.

Well Sites

Mobil's drilling program includes a total of 67 wells (see Map 1-3, in DEIS) which would disturb approximately 3.7 acres each. After the well is in operation, each wellhead facility would require about one acre.

Initially and until 1993, one rig would be used to drill 1.5 to 2 wells per year; it would take approximately six to eight months to drill one well. The expected life of a well is 25 to 30 years. The anticipated work force for drilling is 25; 5 field personnel would be added to Mobil's staff at Big Piney for the life of the project.

Construction, Drilling, and Well Completion

Construction techniques and procedures for the components of the well field would be standard, similar to the techniques previously described for Quasar. The well pad area would be about 400 feet square. Preparation would involve the following earthwork: the land would be leveled, dirt pits would be excavated for the sump pits, and an access road would be constructed so that equipment could be brought to the site. Fugitive dust would be controlled by wetting down areas as necessary. Erosion control and associated revegetation measures would be incorporated to further minimize wind blown dust from exposed subsoil. Similar techniques would be applied on federal, state, private lands. Low-growing shrubs would be allowed to grow on the the rights-of-way.

For Mobil's drilling operation, water would be hauled to the drill site in tank trucks. Mobil presently has several permitted sites in the area from which water can be hauled.

The dehydration and gathering facilities construction would require approximately 40 workers during the three main construction seasons. Construction of the sour gas trunk line would require 200 additional personnel during one construction season.

Wellhead Operation and Abandonment

Facilities at each production wellhead would include free water knockout, dehydrators, meters, water storage, flare, fuel tank, and a control system which includes a remote shut-in value and H_2S detector and warning system. Electric power would be obtained by expanding the existing network that services the sweet gas and oil field. As the gas comes from the well it contains both free-state and vapor-state water. Gas would be dehydrated at Mobil's wellheads using calcium chloride dehydration.

The area for the calcium chloride dehydration system would be a minimum of 200 feet by 200 feet to allow for safety configurations of the components and enclosed by a barbed wire fence. This fence is included to keep large animals away from the equipment. The free water knockout vessel would be approximately 3 feet in diameter by 7 feet long and would probably be a horizontal vessel. Two calcium chloride dehydration vessels would be needed. The second vessel is used temporarily whenever the first is being recharged with calcium chloride. These would be 3 to 3.5 feet in diameter and approximately 30 feet high. A building, approximately 800 square feet in size, would house metering equipment, free water knockout, and possibly the gas-to-gas heat exchanger. Water from the dehydration process would be held in buried tanks. The tanks would periodically be pumped into a disposal system and ultimately into a disposal well. Approximately 32,000 pounds/ well/month of spent calcium chloride (in brine form) would be disposed of by underground injection. A flare of as yet undetermined height

would also be on the site and would be used only to relieve pressure in the dehydration vessels when they are recharged. Recharging would occur approximately every two weeks.

Waste Disposal

Disposal of waste from the well sites would follow the general procedures previously described for Quasar. Estimated solid waste, sanitary waste, and waste water to be generated by the Northwest/Mobil facilities are included in Table 1-10.

Safety

Northwest/Mobil would follow the safety procedures previously described for Quasar.

Required Resources

The water, gravel, and rip rap requirements for well field development are provided in Tables 1-5 and 1-8.

Access Roads

For the most part, the wells to be drilled are adjacent to existing roads and wells. This greatly reduces the amount of new access road construction in the well field. It is estimated that there would be 8 to 10 miles of new access roads built for the 67 wells. These roads would be extensions of existing dirt roads and would be sized and constructed in the same manner.

Gathering System

Untreated or sour gas would be collected from producing wells by a pipeline gathering system. When all 67 wells are producing, there would be about 70 miles of gathering system pipeline. This would disturb approximately 424 acres. The main trunk line from the gathering system to the plant would be approximately 42 miles long and would disturb about 381 acres.

Construction, operation, and abandonment of the Northwest/Mobil gathering system would be similar to the techniques previously described for Quasar.

Treatment Facilities

Treatment Plant

Northwest's treatment plant at Craven Creek would be designed to process 400 million cfd of sour gas. The plant would occupy approximately 55 acres, the evaporation pond approximately 30 acres, and the sulfur storage area would be 80 acres. The overall area of the plant site would be approximately 640 acres. A "zero discharge" concept utilizing the lined evaporation pond at the plant is planned.

The acid gas removal unit would selectively remove sulfur compounds and CO_2. This would produce a sweetened CH_4 stream and CO_2 stream, as well as a H_2S-rich stream to feed the sulfur recovery unit. Following acid gas removal, the sweetened gas would be dehydrated prior to the nitrogen rejection and crude helium recovery steps. A crude helium stream may be produced for upgrading to a saleable by-product. Purification would be done

on site by the purchaser of the helium. The removal of nitrogen and recovery of a raw helium stream would be accomplished using a cryogenic fractionation scheme. Nitrogen would be vented to the atmosphere.

Sulfur would be recovered in an integrated system using Claus technology followed by a tail gas cleanup process. Produced sulfur would be kept in a molten state, stored in an adjacent underground storage tank, and pumped from the tank directly to rail cars. Sulfur would be diverted to block storage only when necessary. In the event of mechanical problems, or should the sulfur sales market deteriorate, a large area would be needed for block sulfur storage. Forty acres would be provided at the east side of the lease to accommodate 20 years of production. A 10-acre evaporation pond about 13 feet deep would adjoin the sulfur block to collect, contain, and evaporate precipitation runoff from the sulfur block. The pond would be lined to prevent seepage.

A 16-inch sales gas pipeline would be built connecting the treatment plant with Northwest's existing 16-inch line 3 miles to the west. Methane compression would be provided to boost the pressure to 850 pounds/square inch, which is pipeline pressure.

CO_2 would be vented until a market is identified. The 16-inch CO_2 pipeline, if constructed, would originate at the plant and extend southeast to U.S. Highway 30. It would continue in a southeasterly direction paralleling the highway and sharing its corridor to the point where the existing MAPCO products pipeline crosses the highway. The CO_2 pipeline would then follow the MAPCO pipeline route. The MAPCO pipeline route has been covered by an environmental impact statement; therefore, for the purposes of the Riley Ridge Project, analysis of the CO_2 pipeline would be limited to the 27-mile distance from the plant to the MAPCO pipeline.

A right-of-way width of 75 feet for construction would be needed with a post-construction width requiring 50 feet. Pipeline construction should average approximately 1 mile per day since the terrain is gentle and the pipeline diameter is not large. A construction work force of 245 would be used and, as is normal for pipeline construction, these people would be expected to find housing in local communities. No construction date can be given. This part of the project depends entirely on finding a buyer for the CO_2.

Power Supply

Power would be obtained from Utah Power & Light Company's Naughton Power Plant south of Kemmerer. The 138-kilovolt transmission line would extend southeast from Naughton paralleling an existing power line. This distance would be approximately 10 miles. The route would then turn to the northeast and continue for 10 miles to where it intersects the proposed railroad spur. The power line would then parallel the railroad spur to the plant site. The total distance is approximately 23 miles. Tangent structures would be wood pole H-frames. These structures would not require concrete footings and grillage; instead, a hole 10-feet deep and 3 to 4 feet in diameter would be dug for each of the two legs. After the legs are placed in the holes, the remaining space would be packed with dirt.

The transmission line construction time would be about seven months. The total work force would be approximately 50 persons including truck drivers, bulldozer operator, crane operator, carpenters, welders, concrete workers, steel workers, tensioners, and linemen. A supervising engineer and inspector would oversee on-site construction. Work crews would be housed in local towns. Operation of the transmission line would involve patrolling the line every month by fixed-wing aircraft, every six months by helicopter, and every year by foot patrol.

An emergency generator would be used to meet minimum power requirements during a power supply outage. This generator would be connected through an automatic switch to an emergency motor control center and would serve the critical loads of the plant. The generator would be driven by a diesel engine. A battery-powered, uninterruptible power system would be used to provide continuous power to critical instrumentation.

Waste Disposal

A completely packaged sewage treatment system would be installed capable of handling the peak sewage flow. A 30-acre evaporation pond would accept the plant effluent water. The pond surface would be large enough to provide full evaporation. No waste water would be discharged to the surrounding area.

The plant would have no continous solid waste discharge other than the trash and human waste generated by the operating personnel. Spent catalyst charges must be changed at 3 to 5-year intervals. These materials are non-toxic, non-polluting, and would be regenerated or disposed of by the catalyst vendor.

Water Supply

Treatment plant water requirements would be supplied from the Green River. A raw water pipeline would extend from a reinforced concrete intake structure on the Green River below the Fontenelle Dam to the plant site. The approximate distance would be 12 miles using 8-inch pipe, buried to a depth of 8 feet. The permanent right-of-way width would be 30 feet with 60 feet for construction. Construction would begin in the spring of 1984 and be completed in 45 days. Approximately 15 workers would be needed, all of whom would find local housing.

Raw water would be stored in a large tank which serves two functions: plant makeup water storage and plant fire water storage. Plant makeup water draw would be taken from the top half of the tank to ensure a constant availability of fire water in the base of the tank. The estimated 1-million gallon tank would provide 2,000 gallons/minute of fire water supply for four hours and about five days of plant water requirements.

An oversized transfer line would be used to provide peak construction water demands. A mobile, packaged water treatment unit would be used to provide potable water during construction. The water treating system would be capable of producing a maximum 130 gallons/ minute of treated water. A separate system would be used to provide potable water for plant personnel as well as all eye wash, safety shower, and laboratory requirements.

Ancillary Plant Facilities

Communications from the plant to the well field would be by microwave. Microwave facilities would be installed at each wellhead facility for monitoring purposes and to shut in any number of wells in case of an emergency. The plant would also use microwave to tie in to the Mountain Bell telephone system. A land line for teletype communication with Union Pacific Railroad may be necessary.

A construction camp is proposed to be built adjacent to the plant site and within the leased area. Approximately 45 acres would be used for the camp. Components would consist of housing units and infrastructure to accommodate a peak capacity of 1,500 persons including camp operating personnel recreational vehicle park and infrastructure for 200 units; kitchen and dining facilities; recreation room, warehouse, and operations building; infirmary; staff housing; parking; water and waste water treatment; and power generation equipment.

Access Road

The plant site access road would be approximately 1.4 miles long, running from Highway 240 directly east to the treatment plant. The road would have a 24-foot wide paved surface with 4-foot gravel shoulders. A minimum 18-inch thickness of well compacted course material would form the base and be overlain by 4 inches of hot plant mix bituminous surface coating. For this road a minimum right-of-way width of 100 feet is needed in order to assure maintainability and provide for accommodations for unusually wide loads during construction and maintenance.

Plant Construction and Operation Schedule

Peak work force would be 1,500, including 1,100 craftsmen, camp personnel, and other support personnel. Site preparation and earthwork would begin in the summer of 1984 and require 200 workers. Foundation construction and underground facilities would be started in the spring of 1985, require 900 people, and last until late winter of 1986. The construction and installation of process facilities and all above-ground structures would be completed by the end of 1986. All mechanical work would be completed in June of 1987 and require a peak work force of 425.

The treatment plant would operate seven days a week and require about 82 people. Approximately 35 would work a basic Monday through Friday daytime schedule; the remaining 47 would work shift schedules and weekends. It is expected that these people would become permanent residents of nearby communities.

Abandonment

Northwest/Mobil would follow similar abandonment procedures as those described for Quasar.

Railroad

A railroad spur from the Union Pacific mainline to the treatment plant would extend from a point about 3 miles east of Opal in a northerly direction to

the west lease boundary, a distance of about 7 miles. Approximately 2 miles of track would be located within the lease for a total of 9 miles. The railway would be built according to the American Railway Engineers Association (AREA) specifications and be consistent with Union Pacific practices. Design limitations are based on 1.5 percent maximum grade and a maximum curvature of 3° on a 100-foot chord.

Right-of-way width on relatively flat ground would only need to be 50 feet. If wide areas are needed for cut and fill, the width may extend to 200 feet. If required, a railroad overpass at U.S. Highway 30 would require 200 feet of right-of-way. Until more detail is known, the right-of-way width is assumed to be 200 feet with an average disturbance width of 100 feet.

Earth work for the railroad bed can be done in about 90 days. Earthwork would be done using standard earth-moving equipment. The road bed would be 34 feet wide at grade with an adjacent and parallel 8-foot wide access road.

Track building would begin with construction of the main switch at Union Pacific's main line. All heavy construction equipment used would be on-track equipment which would ride on the rails as they are laid. Working access would also be via the adjacent access road. Cross ties and track would be laid first and connected. Cross ties would be 8 inches by 8 inches by 8 feet; track would be in 39-foot lengths and weigh 133 pounds/yard. Track can be laid at the rate of 3,000 feet/day under good conditions. The laying of track would be immediately followed by ballast dumping and tamping which would take 90 days. Surface conditioning of ballast would be at the rate of 1 mile/day.

A crew of 25 would construct the roadbed and be housed in nearby towns. A separate crew of 15 would be used for the railroad construction. Either an "outfit car" (a rail car with sleeping and food service facilities) would be provided by the railroad contractor or the crew would stay in local towns. The length of time to construct would be eight months.

Present plans are for a molten sulfur production rate of 757 tons per day. Sulfur rail cars have a nominal capacity of 100 tons and, therefore, about 53 rail cars per week would be loaded. Union Pacific Railroad has estimated that two new employees would be required to handle the traffic created by this plant. These employees would live in and work out of the Kemmerer area. Union Pacific would pick up a string of cars two to five times a week. Sufficient rail siding would be included to accommodate up to 40 cars.

DATA SUMMARY TABLES

TABLE 1-2

LAND REQUIREMENTS FOR THE PROPOSED ACTION[1]

	BLM		FS		BuRec		State		Private		Total	
	Miles	Acres	Miles	Acres	Miles	Acres	Miles	Acres	Miles	Acres	Miles	Acres
Quasar												
Well Sites	0	75	0	148	0	0	0	0	0	40	0	263
Plant Site	0	640	0	0	0	0	0	0	0	0	0	640
Plant Access Roads	2.5	9	0	0	0	0	0	0	0	0	2.5	9
Gathering System	14.0	85	32.0	194	0	0	2.0	12	15.0	91	63.0	382
Well Access Roads	18.5	68	38.0	138	0	0	2.0	7	20.0	73	78.5	286
Trunk Line	6.5	60	0	0	0	0	0	0	0	0	6.5	60
Transmission Lines	1.0	12	0	0	0	0	0	0	0	0	1.0	12
Sales Pipeline	67.5	409	0	0	4.0	24	0	0	15.0	91	86.5	524
CO_2 Pipeline	67.5	409	0	0	4.0	24	0	0	15.0	91	86.5	524
Sulfur Pipeline	4.0	36	0	0	0	0	0	0	0	0	4.0	36
Subtotal	181.5	1,803	70.0	480	8.0	48	4.0	19	65.0	386	328.5	2,736
Williams												
Well Sites	0	59	0	0	0	0	0	4	0	26	0	89
Gathering System	7.0	42	0	0	0	0	1.0	6	25.0	152	33	200
Well Access Roads	21.0	89	0	0	0	0	0	0	8.0	34	29	123
Trunk Line	6.5	60	0	0	0	0	0	0	0	0	6.5	60
Subtotal	34.5	250	0	0	0	0	1.0	10	33.0	212	68.5	472
Exxon												
Well Site	0	234	0	228	0	0	0	13	0	27	0	502
Plant Sites	0	1,280	0	0	0	0	0	0	0	0	0	1,280
Sulfur Loadout	0	80	0	0	0	0	0	0	0	160	0	240
Plant Access Roads	4.5	27	0	0	0	0	0	0	1.0	6	5.5	33
Gathering System	28.0	339	47.0	570	0	0	3.0	36	13.0	158	91.0	1,103
Well Access Roads	37.0	224	49.0	297	0	0	1.0	6	14.0	85	101.0	612
Trunk Line	0.5	6	0	0	0	0	0	0	0	0	0.5	6
Transmission Lines	58.5	709	0	0	0	0	4.0	48	11.0	133	73.5	890
Sales Pipeline	75.5	915	0	0	4.0	48	1.0	12	17.0	206	97.5	1,181
CO_2 Pipeline	75.5	915	0	0	4.0	48	1.0	12	17.0	206	97.5	1,181
Sulfur Pipeline	39.5	360	0	0	0	0	7.0	64	7.5	68	54.0	492
Subtotal	319.0	5,089	96.0	1,095	8.0	96	17.0	191	80.5	1,049	520.5	7,520

TABLE 1-2 (CONTINUED)

	BLM		FS		BuRec		State		Private		Total	
	Miles	Acres	Miles	Acres	Miles	Acres	Miles	Acres	Miles	Acres	Miles	Acres
Mobil/Northwest												
Well Sites	0	248	0	0	0	0	0	0	0	0	0	248
Plant Site	0	640	0	0	0	0	0	0	0	0	0	640
Plant Access Roads	1.0	6	0	0	0	0	0	0	0	0	1.0	6
Gathering System	54.0	327	0	0	0	0	1.0	6	15.0	91	70.0	424
Well Access Roads	79.0	479	0	0	0	0	2.0	12	8.0	48	89.0	539
Trunk Line	35.0	318	0	0	0	0	2.5	23	4.5	40	42.0	381
Transmission Lines	11.0	133	0	0	0	0	0	0	12.0	145	23.0	278
Sales Pipeline	2.0	12	0	0	0	0	0	0	0	0	2.0	12
CO_2 Pipeline	9.0	82	0	0	0	0	0	0	18.0	164	27.0	246
Railroad Spur	5.0	61	0	0	0	0	0	0	2.0	24	7.0	85
Water Pipeline	11.0	80	0	0	1.0	7	0	0	0	0	12.0	87
Subtotal	207.0	2,386	0	0	1.0	7	5.5	41	59.5	512	273.0	2,946
Total	742.0	9,528	166.0	1,575	17	151	27.5	261	238	2,159	1,190.5	13,674

[1]Land required for facility construction. Disturbed areas not needed for permanent facilities would be reclaimed following construction. Existing roads which would be upgraded for well field or plant access are not considered to be new disturbances.

TABLE 1-3

WELL FIELD ACREAGE AND PROPOSED NUMBER OF WELLS BY UNIT

	Acres	Wells
Quasar		
Riley Ridge Unit	16,018	26
North Riley Ridge Unit (Proposed)	18,880	18
Darby Mountain Unit (Proposed)	16,960	26
Exxon		
Lake Ridge Unit	20,990	34
Fogarty Creek Unit	15,861	26
Graphite Unit	3,640	4
Dry Piney Unit (includes Dry Piney Annex)	7,281	11
Mobil		
Tip Top Unit	31,840	51
Hogsback Unit	11,232	16
Williams		
Sawmill Area	17,226	24[1] 2[2]
TOTAL	159,928	238

[1]Wells to be drilled by Williams.

[2]Wells to be drilled by Quasar.

TABLE 1-4

SITE SIZES AND RIGHT-OF-WAY WIDTHS USED FOR DISTURBANCE CALCULATIONS[1]

	Quasar	Williams	Exxon	Northwest	Mobil
			In Acres		
Well Sites	3.7	3.7	6.7	NA	3.7
Plant Sites	640	NA	1,280	640	NA
			In Feet		
Gathering System	50	50	100	50	NA
Plant Access Roads	30	NA	50	50	NA
Well Field Access Roads	30	35	50	NA	50
Sour Gas Trunk Lines	75	75	100	75	NA
Transmission Line[2]	100	NA	100	100	NA
Sales Gas Pipeline	50	NA	100	50	NA
CO_2 Pipeline	50	NA	100	75	NA
Sulfur Pipeline	with Exxon	NA	75	NA	NA
Railroad Spur[2]	NA	NA	100	100	NA
Raw Water Pipeline	NA	NA	NA	60	NA

Source: Companies' Right-of-Way Applications.

NA = Not Applicable

[1]The size of permanent legal right-of-way would vary according to component and agency stipulations.

[2]ERT assumption.

TABLE 1-5

WATER REQUIREMENTS BY SOURCE FOR LIFE OF PROJECT

(IN TOTAL ACRE-FEET/LIFE OF PROJECT)

Activity	Quasar		Williams		Exxon		Mobil/Northwest		Total	
	Green River[1]	Groundwater[2]	Green River[1]	Groundwater[2]	Green River[1]	Groundwater[2]	Green River[1]	Groundwater[2]	Green River[1]	Groundwater[2]
Well Drilling	778	NA	NA	286	NA	670	268	NA	1,046	956
Hydrostatic Testing	28	NA	4	NA	19	NA	30[3]	NA	81	NA
Plant Construction	NA	211	NA	NA	NA	124	160	NA	160	335
Plant Operation	NA	2,010	NA	NA	NA	11,040	2,430	NA	2,430	13,050
Sulfur Loadout										
Construction	NA	see Exxon	NA	NA	NA	1	NA	NA	NA	1
Operation	NA		NA	NA	NA	880[4]	NA	NA	NA	880

[1]Or other nearby surface water source.

[2]Aquifers which would be tapped for groundwater have not been identified.

[3]Estimate

[4]Based on 40-year life of project.

TABLE 1-6

FUEL AND ELECTRICAL ENERGY REQUIREMENTS

	Quasar			Williams			Exxon			Mobil/Northwest			Total		
	Natural Gas[1]	Electricity (Megawatts)	Fuel[2]	Natural Gas[1]	Electricity	Fuel[2]	Natural Gas[1]	Electricity	Fuel[2]	Natural Gas[1]	Electricity	Fuel[2]	Natural Gas[1]	Electricity	Fuel[2]
Well Drilling	NA	NA	25,920	NA	NA	8,640	NA	NA	18,000	NA	NA	16,683	NA	NA	69,243
Well Operation	NA	0.7	NA	NA	0.2	NA	NA	80 (dehydration)	NA	0.02	0.6	NA	NA	81.5	NA
Plant Construction	NA	2.4	390	NA	NA	NA	NA	12	70	NA	2.5	50	NA	16.9	510
Plant Operation	2.9	175	30	NA	NA	NA	17	218	2,400	1.1	65	300	21	458	2,730
Sulfur Pipeline and Loadout															
Operation	NA	NA	NA	NA	NA	NA	NA	6	11,600	NA	NA	NA	NA	6	11,600
Construction	NA	NA	NA	NA	NA	NA	NA	NA	33	NA	NA	NA	NA	NA	NA
TOTAL	2.9	178.1	26,340	NA	0.2	8,640	17	316	32,103	1.1	68.1	17,033	21	562.4	84,116

[1]Million standard cubic feet/day.

[2]Thousands of gallons/life of project.

TABLE 1-7

AVERAGE ANNUAL EMPLOYMENT PROJECTIONS

Location	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995-2000
Quasar													
Well Field Drilling	0	94	220	220	220	220	220	40	0	0	0	0	0
Well Field Operation	0	0	5	26	28	28	28	28	28	28	28	28	28
Linear Facilities Construction	0	239	437	49	49	49	49	49	0	0	0	0	0
Linear Facilities Operation	0	0	5	26	28	28	28	28	28	28	28	28	28
Plant Construction	0	100	425	213	213	213	213	16	0	0	0	0	0
Plant Operation	0	0	16	75	125	138	150	150	150	150	150	150	150
Williams													
Well Field Drilling	0	44	40	40	40	40	40	30	0	0	0	0	
Well Field Operation	0	9	15	16	17	18	19	29	47	47	47	47	47
Linear Facilities Construction	0	0	0	95	0	0	0	0	0	0	0	0	0
Linear Facilities Operation	0	3	5	8	10	13	14	15	15	15	15	15	15
Exxon													
Well Field Drilling	0	60	120	120	120	120	120	120	120	120	120	120	102
Well Field Operation	0	0	5	13	20	23	33	43	53	60	60	60	60
Linear Facilities Construction	0	23	501	355	0	3	133	0	0	0	0	0	0
Linear Facilities Operation	0	0	7	35	35	35	36	40	43	45	45	45	45
Plant Construction	0	281	535	390	369	406	450	406	344	150	91	0	0
Plant Operation	0	0	33	94	150	169	244	319	394	450	450	450	450
Mobil													
Well Field Drilling	25	25	25	25	25	25	25	25	25	25	37	37	37
Well Field Operation	14	14	14	15	15	15	15	15	15	16	16	16	16
Northwest													
Linear Facilities Construction	0	22	20	240	20	0	0	0	0	0	0	0	0
Linear Facilities Operation	0	0	0	9	30	30	30	30	30	30	30	30	30
Plant Construction	0	77	542	972	108	0	0	0	0	0	0	0	0
Plant Operation	0	0	5	82	82	82	82	82	82	82	82	82	82
Total	39	991	2,975	3,118	1,704	1,655	1,929	1,465	1,374	1,246	1,199	1,108	1,108

Note: Linear facilities include pipelines, electric transmission lines, access roads, and railroads.

TABLE 1-8

ESTIMATED GRAVEL AND RIPRAP REQUIREMENTS FOR CONSTRUCTION
(IN CUBIC YARDS)

	Quasar	Williams	Exxon	Mobil/ Northwest	Total
Well Field Development					
Gravel	452,100	150,000 (est.)	350,000	5,500	957,60
Riprap	90,000	30,000 (est.)	19,000	None	139,00
Plant Construction					
Sand/Gravel	238,900	NA	180,000	96,000	514,900
Riprap	100,000	NA	None	None	100,000
Asphalt (access roads)	300	NA	130	180	610
Railroad Construction					
Sand/Gravel	NA	NA	NA	23,000	23,000
TOTAL	881,300	180,000	549,130	124,680	1,735,110

[1]Borrow material would be obtained from local approved sources which may be subject to further environmental analysis at the time these sources are identified.

[2]Exxon's sulfur transport railroad (Component Alternative) would require 225,000 cubic yards of sand/gravel.

TABLE 1-9

EMISSIONS SUMMARY[1]

(IN TONS/YEAR)

	Quasar	Exxon	Northwest/ Mobil	Total
Plant Capacity (billion cfd)	1.2	1.2[2]	0.4	2.8
CO	458	264	6,145	6,867
COS[3]	4,126	4,126	52	8,304
CO_2[4]	17,613,000	17,007,000	5,587,000	40,207,000
He	10,722	10,722	3,854	25,298
H_2S	170	106	97	373
N_2	4,144,000	4,618,000	909,779	9,672,000
NO_x	2,104	1,249	323	3,676
SO_2	6,745	5,579	3,509	15,833
TSP[5]	156	92	25	273
VOC[6]	194	112	33	339

[1]Includes temporary emissions during well drilling, plant start-up, testing, and upset conditions, as well as emissions during routine operation.

[2]Includes both of Exxon's plants at West Dry Basin and Big Mesa.

[3]COS is carbonyl sulfide

[4]Assumes that all CO_2 is vented.

[5]TSP is total suspended particulates.

[6]VOC is non-methane volatile organic compounds.

TABLE 1-10

SOLID WASTES, SANITARY WASTES, AND WASTE WATER GENERATED

	Quasar	Williams	Exxon	Mobil/ Northwest	Total
Solid Wastes (in yd^3/yr)					
Construction	16,000	4,000[1]	20,000	20,000	60,000
Operation	2,500	500[1]	6,500	2,500[1]	12,000
Sanitary Wastes (in ac-ft/yr)					
Operation	1.8	1.4[1]	10	40	53.2
Waste Water (in ac-ft/yr)					
Dehydration[2]	Included below	110	120	200[4]	430
Plant Operation[3]	725	NA	725	60[5]	1,510

[1]Estimated value for analysis purposes.

[2]Projected chemical quality of effluent from wellhead dehydration is 193 milligrams/liter (mg/l) of CO_2, 366 mg/l of H_2S, and 2,000 mg/l of total dissolved solids (Exxon 1982).

[3]Projected chemical quality of treatment plant effluent is 600 parts/million (ppm) H_2S, 730 ppm of total reduced sulfur, 2,200 ppm chemical oxygen demand, and less than 0.1 ppm of chromium, lead, nickel, copper, zinc, mercury, and arsenic (Exxon 1982).

[4]Assumes 3 acre-feet/well/year.

[5]Assumes 75 percent of the annual water requirement is discharged.

TABLE 1-11

PROPOSED WELL FIELD ACCESS ROADWAY SYSTEM
(IN MILES)

Well Field Unit	Road Type				Roads Outside of Well Field Boundary	Total
	New[1]	Primitive[2]	Secondary[3]	Existing[4]		
Hogsback	1.0	6.7	12.2	1.7	--	21.6
Tip Top	8.3	21.3	19.2	18.5	--	67.3
Dry Piney	1.1	2.0	8.7	4.7	--	16.5
Graphite	1.1	2.1	0.0	2.6	--	5.8
Fogarty Creek	11.6	8.5	2.5	5.3	3.4	31.3
Lake Ridge	16.9	11.8	1.1	12.5	5.1	47.4
Sawmill	11.0	10.0	0.0	8.1	--	29.1
Riley Ridge	10.0	13.1	0.0	5.9	--	29
North Riley Ridge	8.4	9.4	0.0	11.0	--	28.8
Darby Mountain	6.4	5.9	0.0	7.1	1.5	20.9
Total All Units	75.8	90.8	43.7	77.4	10.0	297.7

[1]Access roads constructed where none currently exist.

[2]Single-lane roads upgraded to access roads.

[3]Lane-and-a-half roads upgraded to access roads.

[4]Two-lane roads not requiring upgrading.

TABLE 1-12

TYPICAL PRIMARY DRILLING FLUID CONSTITUENTS

Additive	Primary Function
Bentonite (Clay)	Viscosifier, Filtrate Reducer
Polymer Clay Extender	Viscosifier
Hydrated Lime	pH Control
Organic Polymer	Filtrate Reducer
Chrome Free Lignosulfonate	Flow Property Control
Lignite	Flow Property Control
Caustic Soda	pH Control
Barite	Weight Material
Salt	Weight Material
Zinc Chloride	H_2S Scavenger
Soda Ash	Calcium Control

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